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SHIPPING AND COOLING-IN-CAR TESTS WITH ORANGES IN FIBERBOARD CARTONS IN DIFFERENT LOAD PATTERNS, 1953

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CONTENTS

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SUMMARY

Twenty-one cooling-in-car tests were made with non-precooled Valencia and Washington Navel oranges in cartons, and one test was made with a standard orange load of 462 boxes. For comparative purposes some of the loads were experimentally opened to provide greater space for air circulation than exists in the carton loads now in use. This opening was achieved with different amounts of load channeling with and without spreaders. The greater air flow through the loads seemed to improve the cooling-in-car performance, but not so much as was anticipated. The barriers offered to heat transfer within the carton unit itself may be considered an important limiting factor when rapid precooling is attempted.

The T load, one of the patterns introduced in these tests, was considered promising enough to warrant extensive commercial trial.

INTRODUCTION

This report is the fourth which deals with cooling and transportation of California oranges in fiberboard cartons.

The first presented the results of a transportation test in the summer of 1952 with lemons and oranges (H. T. & S. Office Report No. 281). The test was principally with lemons, but four cars of non-precooled oranges, one a solid carton load, were included. The transit temperatures in the center of this load were so high that need for further study was evident. Similar high temperatures had been noted in some previous shipping tests with mixed loads of oranges in cartons and standard wooden boxes.

The second report dealt with shipping tests with cartoned Valencia oranges precooled to about 40°F. before loading. The results seemed to warrant the conclusion that precooled oranges in cartons offered no special transport difficulty. (H. T. & S. Office Report No. 283). While these results were favorable, the problem remained unsolved for the shipper not having precooling facilities in the packing house.

The third report presented the results of a series of shipping tests with non-precooled Navel oranges in cartons conducted for the purpose of obtaining more detailed information on the rate and amount of cooling in commercial loads as affected by such factors as vented and nonvented cartons; solid and chimney loads; ice refrigeration; and CIC (cooling in car before departure). (H. T. & S. Office Report No. 283). The results showed some advantage in cooling for the vented over the nonvented carton and for the chimney load over the solid one. However, it was stated that because of the slow rate of cooling in the center of the load, no combination of carton type with load patterns, refrigerator car equipment or refrigeration service provided as good cooling as usually obtained with standard box loads.

In a number of tests with solid and chimney loads of cartons the temperature of non-precooled oranges centrally located in the load continued to rise for a day or two or even more in preiced cars. The heat of respiration of the oranges, therefore, exceeded heat transfer from the interior of the load until the temperature of the outer parts of the load had been reduced to produce a sufficient heat gradient. A similar rise in temperature had been observed on a few occasions during cooling-in-car operations. This situation is likely to occur in tight loads whenever the loading temperature of the oranges exceeds 80°F.

It now became clear that if satisfactory transit refrigeration were to be obtained, the load of cartons of non-precooled oranges should be repatterned so as to permit better circulation of air through it. The present report covers studies of which the chief purpose was to observe the effect on rate of cooling of a more open carton load. Information concerning the tests is summarized in table 1. The investigations were concerned with non-precooled Valencia oranges from southern California in July to October, 1953, with non-precooled Washington Navel oranges from central California in December. Types of loads used are shown in figures 1 to 3.

GENERAL DESCRIPTION OF TESTS

There were 22 cars included in the precooling tests. And because of the numerous differences in car equipment, precooling methods, containers and loading patterns, etc., each car was considered a separate test. Ten cars were used for the Valencia oranges and twelve for the Navel oranges. One test load was of standard orange crates (462), and the remainder were of $\frac{1}{2}$-box size fiberboard cartons. All test cars were under observation during the interval from loading to the end of the precooling period.

Temperatures within the cars were measured with thermocouples placed in seven to eleven positions in the loads and read from outside the car. The thermocouples were removed immediately after precooling. Four Ryan recording thermometers were installed in each of five test cars of Navel oranges, and were not removed until the cars reached their destinations. A fifth Ryan was attached beneath the cars at doorway to record outside air temperature in transit.

The positions of the Ryan thermometers and the symbols representing them were as follows:

Top quarter centerline	=	TQCL
Middle quarter centerline	=	MQCL
Middle quarter at car wall	=	MQ wall
Middle doorway centerline	=	MDCL
Outside air	=	OA

The positions of the thermocouples varied with the number of thermocouples in the set. For tests 11 to 22, inclusive (see table 3) there were 11 thermocouples. Their positions and symbols for the

additional positions used were as follows:

Top bunker centerline	= TBCL
Middle bunker centerline	= MBCL
Bottom bunker centerline	= BBCL
Bottom quarterlength centerline	= BQCL
Top doorway centerline	= TDCL
Bottom doorway centerline	= BDCL
Top air	= TA
Bottom air	= BA

All test loads consisted of approximately 1040 cartons. The experimental patterns of loading were mainly two: Channeled and T loads (figs. 1 and 3). Other load modifications are indicated for tests 11, 20 and 21 in tables 3 and 4. The T load is described here in some detail because the amount of planned open space it affords seems to be near the limit that can be hoped for without the use of expensive and inconvenient spreaders or gates.

The load pattern calls for five unit blocks of cartons. The dimensions of these units are such that they leave a space across the car at the doorway, 36 inches wide that may be filled optionally. Each unit consists of 186 cartons in six layers and provides twelve vertical openings through the load. Each opening is 3 by 18 inches, or 54 square inches, giving a total cross section of 648 square inches for ventilation in each unit block.

A modification of the T load, referred to as the Creeks load was used in tests 20 and 21 (see fig. 3). Seven of the loads were variously channelized; the extent to which they were channelized is indicated in table 1 (see tests 1, 2, 3, 9, 18, 19 and 22).

The current commercial 3-chimney loads were used in tests 5, 8, and 16, and a modified chimney load in test 11. The pattern of the chimney load is shown in figure 2.

RESULTS

Precooling temperatures: The general results from the precooling tests with Valencia oranges (tests 1 to 10) except for the load of standard orange crates (test 10) may be considered unsatisfactory. Tests 4 to 8, which were the current commercial carton loads, showed quite inadequate precooling. Also, the experimental loads of tests 2 and 9 showed very unsatisfactory cooling. But in test 1 the temperature at the middle quarter centerline position lowered 13°F. Test 3 showed a satisfactory drop of 18°F. at middle quarter position from the loading to end of precooling (see table 2). Largely because of this result and the hope for further favorable effects the tests were soon resumed in central California with Washington Navel oranges.

When the results from the additional tests in central California were examined, it seemed that car precooling of non-precooled oranges in fiberboard cartons, as reported here, was not entirely successful. However, tests 3, 11, and 17, and perhaps 16, were encouraging.

The generally small benefit which accrued from the added space between the cartons indicates that under present conditions little further improvement from load openness can be expected. Two methods were used to compare the relative amount of openness in the loads used in the tests. One was the percentages of total surface areas of sides and ends of the cartons actually exposed to the vertical air channels provided (tops and bottoms of the cartons were presumed to have the same exposure in all load patterns). The other was the total cross-sectional area of the vertical channels.

According to the first method, the channeled loads of tests 18, 19, and 22 allowed about 30 percent of the total surface of the sides and end of the cartons to be adjacent to a vertical air space. On the same basis, the T load, used in several tests, allowed a direct exposure of about 27 percent of the side and end surfaces, while the current 4-unit chimney load allowed less than 10 percent. According to the second method of comparing openness of loads the channel, T, and chimney loads provide, respectively, about 3600, 3400, and 1400 square inches of total cross section of vertical spaces.

The problem of satisfactorily precooling non-precooled loaded oranges seems to have encountered several limiting factors. They are the slow rate of heat transfer from the interior of the carton to its surface, the shortness of the precooling period now being used, and the generally too-mild temperature of the night air when outdoor air was used for precooling. The delay, additional expense, and inconvenience involved in lengthening the precooling period probably would be too objectionable for acceptance by orange shippers. However, in some test shipments of cranberries in cartons from Cape Cod area to Los Angeles, excellent in-car-cooling was obtained in 24 hours with channeled loads in preiced cars with Preco fans.

Transit temperatures and condition of loads at destination: In tests 12, 13, 14, 21 and 22 Ryan recording thermometers were installed for obtaining transit temperatures; consequently these served also as shipping tests. These temperatures are shown in table 4 and figures 12 to 16. Those five tests made in December with Navel oranges from central California were very similar in behavior. The average difference in temperature between the middle and the top quarter centerline positions of the tests ranged from 6 to 11 degrees. By the time of arrival in New York these differences had been reduced to 4 to 7 degrees. In all tests the middle quarter centerline was the warmer. During precooling the top quarter centerline showed a greater drop in temperature than the middle quarter centerline, but in transit the reverse was true. The average outside air temperatures encountered in the five tests was very near 32°F.

Official reports on the condition of the experimentally opened loads on arrival at destinations were obtained for the five shipping tests to New York. The reports on the arrival condition for the other precooled cars consisted merely of statements from the shippers that no reports of bad conditions had been received.

The following remarks and quotations concern the tests to New York.

Tests 12 and 13 consisted of T loads except for an unbonded sixth stack (fig. 3). From the inspection report comes the following excerpt: "Some creasing, especially in the on-side wall cartons, was noted; however, no breakage was seen. The lengthwise packages in the mixed rows shifted in some cases. The upper layers either shifted, or the entire column leaned, closing some of the chimney channels to give 3 channels in some stacks rather than the expected 6. In general, the channels at arrival measured 0-6 inches, most of them being 2-3 inches. Bad side shifting was found in the sixth stacks from each bunker".

Test 14 had a correct T load (fig. 1). "This load arrived in better condition than the first two received. The condition noted in cars of tests 12 and 13 in the sixth stack was corrected by the modification in load pattern. Fewer cartons were loaded on side and there was therefore less creasing. There was some shifting away from the B-end bunker, averaging about 1 inch at the bottom and 9 inches at the top layer. In the B-end some packages were tilted, about 4 inches in the top layer. The A-end had no tilt but the packages over-lapped. No packages were rejected for creasing." "The load pattern gives us a favorable impression."

Test 21 used a Creeks load (fig. 3). "The load pattern at arrival varies from the loading diagram received, due to general crosswise disarrangement. The 3x18 inch channels were generally closed, and the 3x6 inch channels were irregular in shape and generally enlarged. A very few of the 3x6 inch chimneys became L-shaped due to the closure of some 3x18 inch channels and their transference to the chimney side of the column which moved." "The load pattern in this test appears to be less desirable than the general pattern found in the first three tests."

In test 22 the load was longitudinally channeled with vertical wood spreaders. "The metal cleats on the 1 5/8" x 2 3/4" spacers cut into many cartons, making this load the least desirable of the five shipped to date. This cutting and chafing was especially bad at the upper cleat where the most transit movement of cartons occurred. The other undesirable feature of this load pattern is the uniform lack of lateral support to the carton walls". (Only the corners of the cartons were in contact with the spreaders.)

CONCLUSIONS

The precooling accomplished in these tests has been judged by the temperatures in the central positions of the load, middle layer quarter-length, where cooling is difficult. Much of the fruit in the car is similarly unfavorably located for cooling and only a small portion in the top layer is well exposed for cooling. It seems highly probable that further aids in this precooling problem may come through improvement in handling in the packing houses or in the design of the cartons themselves. The latter is now being given special attention by carton manufacturers.

If it were feasible to change the vents from their present location in the top and bottom of the cartons to four points near the corners of the sides considerable benefit should be anticipated. Then, as in the T load for example, twelve such vents should have free access to each 3x18 inch vertical void for each layer of the load during any precooling-in-car operation.

Table 1. Summary of loading, car and precooling data

Test	1	2	3	4	5	6	7	8
Date	Aug. 1	Aug. 27	Oct. 9	Aug. 29	Aug. 29	Sept. 4	Sept. 1	Sept. 1
Loaded :	Garden Grove	Garden Grove	Garden Grove	Upland	Placentia	Upland	Placentia	Placentia
Precooled:	Colton	Colton	Colton	San Bernardino	San Bernardino	San Bernardino	San Bernardino	San Bernardino
Fans	Floor	Electric	Electric	Floor	Floor	Electric	Electric	Electric
Flues	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Floor racks	Wood	Metal	Wood	Metal	Wood	Metal	Metal	Metal
Load type	½-inch channel	½-inch channel	2-inch channel	Solid (loose)	3-chimney	Solid (5-lb. bags)	Solid	3-chimney
Carton type	Vented	Vented	Vented	Vented	Vented	Vented	Non-vented	Non-vented
Code No.	CCA6	CCA6	CCA6	CCA6	IP-11	CCA8	IP-10	IP-10
Collar	No	No	No	No	Yes	No	Yes	Yes
Icing service	PI-HS-Repl.	PI-HS-Repl.	PI-HS-Repl.	Dry car	Dry car FB after PC	Dry car FB before PC	Dry car FB after PC	Dry car FB after PC
Precooling service	RR	RR	RR	RR	RR	Car fans	RR	RR
Hours precooled	8	8	8	8	8	17½ See ice meltage record	8	8
Middle Quarter temperatures (°F.) of orange loads immediately before and after precooling.								
Initial	76	66	61	81	79	78	75	77
Final	63	66	55	72	70	72	74	75
Reduction	13	0	6	9	9	6	1	2

CIC-Cooled-in-car, referring to cooling with outside air.
DNR-do not reice.
Dry car-iced after loading.
FB-full bunker icing.
HS-half stage icing.
II-initial icing.
PC-precooling.
PI-preiced.
Repl.-replenished.
RR-carrier precooled.

Carton codes
CCA6-7-8-California Container Corp. cartons.
IP-10-11-International Paper Co. cartons
LV-3V-Longview Fiber Co. cartons

Table 1 Con't.

Test	9	10	11	12	13	14	15
Date	Sept. 1	Sept. 1	Dec. 4	Dec. 7	Dec. 7	Dec. 8	Dec. 8
Loaded :	Placentia	Placentia	Sunflower	Sunland	Sunland	Strathmore	Strathmore
Precooled:	San Bernardino	San Bernardino	Sunflower	Sunland	Sunland	Strathmore	Strathmore
Fans	Electric	Electric	None	Floor	Floor	Floor	Electric
Flues	Yes	Yes	No	Yes	No	Yes	Yes
Floor racks	Metal	Metal	Wood	Metal	Metal	Metal	Metal
Load type	½-inch cross channel	Standard (462 boxes)	2-chimney	T	T	T	T
Carton type	Non-vented	Standard	Vented	Vented	Vented	Vented	Vented
Code No.	IP-10	Wood box	LV-3V	LV-3V	LV-3V	LV-3V	LV-3V
Collar	Yes	--	Yes	Yes	Yes	Yes	Yes
Icing service	Dry car FB before PC	Dry car FB before PC	Dry car	Dry car	PI-repl-DNR	Dry car	Dry car
Precooling service	Car fans	Car fans	Portable fans outside air	Car fans outside air	Car fans	Car fans outside air	Portable fans outside air
Hours precooled	16 See ice meltage record	16 see ice meltage record	8	7+	7+	6½	3½
Middle Quarter temperatures (°F.) of orange loads immediately before and after precooling.							
Initial	79	74	72	68	67	76	71
Final	75	51	49	65	58	68	63
Reduction	4	23	23	3	9	8	8

Table 1 Con't.

Test	16	17	18	19	20	21	22
Date	Dec. 8	Dec. 9	Dec. 10	Dec. 10	Dec. 11	Dec. 11	Dec. 12
Loaded :	Strathmore	Lindsay	Orange Cove	Orange Cove	Sunland	Sunland	Lindsay
Precooled:	Strathmore	Lindsay	Orange Cove	Orange Cove	Sunland	Sunland	Lindsay
Fans	Floor	Floor	Floor	Floor	Floor	Floor	Electric
Flues	No	No	No	No	No	No	No
Floor racks	Wood	Wood	Metal	Metal	Wood	Wood	Wood
Load type	3-chimney	T	2-inch channel	2-inch channel	Creeks T	Creeks T	2-inch channel
Carton type	Vented	Vented	Vented	Vented	Vented	Vented	Vented
Code No.	LV-3V	LV-3V	CCA7	CCA7	LV-3V	LV-3V	LV-3V
Collar	Yes	Yes	No	No	Yes	Yes	Yes
Icing service	Dry car	Dry car	Dry car	PI-repl-DNR	Dry car	Dry car	Dry car
Precooling service	Car fans outside air	Car fans[1/] outside air	Car fans[2/] outside air	Car fans	Car fans outside air	Car fans outside air	Portable fans outside air
Hours precooled	8	9 + 9	8	8	5	8	12
Middle Quarter temperatures (°F.) of orange loads immediately before and after precooling.							
Initial	75	74	76	75	75	74	73
Final	61	60	71	69	73	65	66
Reduction	14	14	5	6	2	9	7

1/ 2 portable hatch fans used in addition to car fans.

2/ Car fans started at 8 a.m. - ran during loading and continued during precooling.

Table 2. Precooling temperatures (°F.) of Valencia oranges in fiberboard cartons in southern California. Temperatures obtained by thermocouples inserted in fruit. Ice meltage records are presented for Tests 6, 9 and 10.

Test 1. Preiced car, half stage, replenished by shipper.
Floor fans, wall flues, wood floor racks.
½-inch lengthwise channels with fiberboard spreaders.
Vented cartons (CCA6), no collars.
Loaded at Garden Grove, July 29-30.

Date	Time	TA	BQCL	MQCL	TQCL	BDCL	MDCL	TDCL	MQSS [1]	MDSS	TDSS
July 30	4:30 p.m.	72	70	73	74	76	77	76	73	79	76
30	5:00 p.m.	75	73	76	76	78	79	79	76	81	78
	Moved to Colton for precooling										
Aug. 1	10:00 p.m.	82	71	76	78	73	78	79	77	78	78
2	3:00 a.m.	Start of precooling by carrier									
	11:00 a.m. [1]	54	--	63	38	--	65	46	--	--	--
		End of precooling (8 hours) (See fig. 4)									

[1] These readings were taken with a fruit thermometer. Thermocouples failed to record correctly after switch box was exposed to cold air blast.

Test 2. Preiced car, half stage, replenished by shipper.
Electric fans, wall flues, metal floor racks.
½-inch lengthwise channels with fiberboard spreaders.
Vented cartons (CCA6), no collars.
Loaded at Garden Grove, August 25-26.

Date	Time	TA	BQCL	MQCL	TQCL	BDCL	MDCL	TDCL	MQSS	MDSS	TDSS
Aug. 25	12 noon	74	73	72	73	71	70	75	74	74	74
26	3:30 p.m.	78	54	66	73	52	67	71	68	69	71
	Moved to Colton for precooling										
27	4: 00 p.m.	81	54	66	74	55	67	74	67	68	73
	8:00 p.m.	Start of precooling by carrier									
28	4:00 a.m.	52	58	66	60	55	68	69	64	68	67
	End of precooling (8 hours) (See Fig. 4)										

[1] SS - south side of car.

Table 2 con't. Precooling temperatures (°F.) of Valencia Oranges continued.

Test 3. Preiced car, half stage, replenished by shipper.
Electric fans, no wall flues, wood floor racks.
2-inch lengthwise channels with fiberboard spreaders.
Vented cartons (CCA6), no collars.
Loaded at Garden Grove, Oct. 7-8.

Date	Time	TA	BA	MBCL	BQCL	MQCL	TQCL	BDCL	MDCL	TDCL	SPECIAL MDCL 1/
Oct. 7	2:30 p.m.	--	48	78	71	73	77	75	79	80	72
8	4:00 p.m.	75	45	69	54	66	73	62	72	72	66
	Moved to Colton for precooling										
9	3:30 p.m.	71	53	63	52	61	68	57	67	68	62
	4:00 p.m.	Start of precooling by carrier									
10	12:01 a.m.	31	35	59	46	55	63	54	66	63	61
		End of precooling (8 hours) (See fig. 5)									

1/ SPECIAL MDCL - Thermocouple in carton with slots in sides instead of top and bottom.

Test 4. Dry car, solid pattern load but very loose.
Floor fans, wall flues, metal floor racks.
Vented cartons (CCA6), no collars.
Thermocouples installed at San Bernardino after loading at Upland.

Date	Time	OA	BQCL	MQCL	TQCL	FDCL	MDCL	TDCL	Air in carton TQCL	Air in carton TDCL
Aug. 29	7:40 a.m.	63	73	81	80	75	77	81	81	76
	8:00 a.m.	Start of precooling								
	9:00 a.m.	65	71	78	71	71	73	74	74	62
	10:20 a.m.	71	71	76	61	67	70	64	65	54
	11:35 a.m.	73	71	75	54	64	69	58	56	36
	12:50 p.m.	75	70	74	48	62	68	53	50	34
	2:05 p.m.	77	68	74	47	60	68	50	53	41
	2:50 p.m.	77	67	73	47	59	67	49	49	34
	3:55 p.m.	76	66	72	44	57	66	45	51	41
	4:00 p.m.	End of precooling (8 hours) (See fig. 5)								
	4:29 p.m.	72	65	72	46	57	66	46	53	45

Table 2 con't. Precooling temperatures (°F.) of Valencia oranges con't.

Test 5. Dry car, chimney load, 3 rows of 4-unit chimneys.
Floor fans, no wall flues, wood floor racks.
Vented cartons (IP-11), with collars.
Thermocouples installed at San Bernardino after loading at Placentia.

Date	Time	OA	MQCL 1/	MQCL 2/	TQCL	BDCL	MDCL	TDCL
Aug. 29	8:50 a.m.	--	70	79	73	74	76	77
	8:55 a.m.	Start of precooling by carrier						
	10:30 a.m.	71	73	76	69	71	76	72
	11:30 a.m.	73	70	75	65	68	75	69
	12:55 p.m.	75	67	73	62	66	74	64
	2:10 p.m.	77	65	72	59	65	73	58
	3:00 p.m.	77	64	71	58	64	72	55
	4:00 p.m.	76	63	70	56	63	72	51
	5:00 p.m.	72	63	70	55	62	71	48
	4:55 p.m.	End of precooling (8 hours) (See fig. 5)						

1/ Near chimney 2/ Away from chimney

Test 6. Dry car, initial icing before precooling with car fans.
Electric fans, wall flues, metal floor racks.
Solid load, vented cartons (CCA8), 5-lb. bags, no collars.
Loaded Upland, Sept. 2-3. First reading at San Bernardino.

Date	Time	OA	BQCL	MQCL	TQCL (6th)	BDCL	MDCL	TDCL	TQCL (5th)	MBCL	CEILING AIR
Sept. 4	5:45 a.m.	59	76	78	61	58	56	60	57	76	69
	6:00 a.m.	Start of precooling									
	6:45 a.m.	59	76	78	72	79	81	75	80	76	46
	7:45 a.m.	60	75	78	68	80	82	74	78	75	42
	9:45 a.m.	65	73	76	62	79	81	70	77	74	40
	1:45 p.m.	84	70	75	49	75	78	62	66	72	41
	5:45 p.m.	75	69	75	48	78	80	58	68	72	41
	9:45 p.m.	64	66	73	48	77	79	55	65	70	40
	11:15 p.m.	61	65	72	45	77	79	54	64	70	40
	11:35 p.m.	End of precooling (17½ hours) (See fig. 6 and ice meltage record below.									

Test 6. Ice meltage during precooling recorded as pounds of water collected from bunker drains and weighed hourly.

Hours:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	17½	Total
B-end	80	75	60	65	78	134	136	143	142	136	154	137	135	139	125	122	125	62	2048
A-end	108	126	73	84	131	155	143	163	157	140	165	141	136	140	127	116	116	64	2285
Total pounds	188	201	133	149	209	289	279	306	299	276	319	278	271	279	252	238	241	126	4333

Table 2 con't. Precooling temperatures (°F.) of Valencia oranges continued.

Test 7. Dry car, initially iced after precooling by carrier.
Electric fans, wall flues, metal floor racks.
Solid load, non-vented cartons, (IP-10), with collars.
Loaded at Placentia, Aug. 31. First reading at San Bernardino.

Date	Time	OA	BQCL	MQCL	TQCL 1/ (6th)	BDCL	MDCL	TDCL	TQCL 2/ (5th)	MBCL	AIR IN WALL FLUE
Sept. 1	4:30 a.m.	56	75	75	74	75	76	75	75	75	70
	4:40 a.m.	Start of precooling									
	5:40 a.m.	55	72	75	74	75	76	75	76	76	39
	6:40 a.m.	57	70	74	74	74	75	75	75	75	33
	8:40 a.m.	64	71	74	72	75	75	76	74	74	49
	10:40 a.m.	71	71	75	68	73	72	74	74	75	39
	12:40 p.m.	80	71	74	66	71	71	73	74	75	37
		End of precooling (8 hours) (See fig. 6)									

Test 8. Dry car, initially iced after precooling by carrier.
Electric fans, wall flues, metal floor racks.
Non-vented cartons (IP-10), with collars.
Chimney load, 3 rows of 4-unit chimneys.
Loaded at Placentia, Aug. 31. First reading at San Bernardino.

Date	Time	OA	BQCL	MQCL	TQCL 1/ (6th)	BDCL	MDCL	TDCL	TQCL 2/ (5th)	MBCL	AIR IN WALL FLUES
Sept. 1	4:30 a.m.	56	75	77	77	77	75	78	76	77	
	4:30 a.m.	Start of precooling									
	5:40 a.m.	55	75	77	76	77	75	77	76	77	
	6:40 a.m.	57	75	76	76	77	75	77	76	76	
	8:40 a.m.	64	74	76	72	75	75	74	75	76	
	10:40 a.m.	71	72	76	72	74	75	72	75	76	
	12:40 p.m.	80	70	75	69	72	74	69	75	75	
		End of precooling (8 hours) (See fig. 6)									

1/ Thermocouples in 6th layer of cartons. 2/ Thermocouples in 5th layer of cartons.

Table 2 con't. Precooling temperatures (°F) of Valencia Oranges con't.

Test 9. Dry car, initially iced before precooling with car fans.
Electric fans, wall flues, metal floor racks.
Non-vented cartons (IP-10), with collars.
Cross channels between stacks with ½-inch fiberboard strips.
Loaded at Placentia, Aug. 31. First reading at San Bernardino.

Date	Time	OA	BQCL	MQCL	TQCL (6th) [1/]	BDCL	MDCL	TDCL	TQCL (5th) [2/]	MBCL
Sept. 1	5:05 a.m.	56	78	79	77	79	80	79	78	75
	5:35 a.m.	Start of precooling								
	6:05 a.m.	56	76	77	76	78	79	78	77	75
	7:05 a.m.	58	76	78	75	76	78	77	77	74
	9:05 a.m.	67	75	78	73	73	76	75	76	73
	11:05 a.m.	75	75	77	71	71	75	72	75	73
	1:05 p.m.	81	73	76	68	68	72	68	73	71
	5:05 p.m.	75	72	76	67	67	71	66	73	72
	9:05 p.m.	63	70	75	64	65	69	63	71	71
	End of precooling (16 hours) (See fig. 7 and ice meltage record below)									

Test 9. Ice meltage during precooling recorded as pounds of water collected from bunker drains and weighed hourly.

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
A-end	94	103	113	120	123	130	148	163	153	151	161	139	156	134	129	132	2149
B-end	153	134	134	139	165	154	158	173	158	154	161	150	163	135	138	141	2410
Total pounds	247	237	247	259	288	284	306	336	311	305	322	289	319	269	267	273	4559

1/ Thermocouple in 6th layer of cartons at centerline.

2/ Thermocouple in 5th layer.

Table 2 con't. Precooling temperatures (°F.) of Valencia oranges con't.

Test 10. Dry car, initially iced before precooling with car fans. Electric fans, wall flues, metal floor racks. Standard 462 box load. Loaded at Placentia Aug. 31. First reading at San Bernardino.

Date	Time	OA	BQCL	MQCL	TQCL[1] (6th)	BDCL	MDCL	TDCL	TQCL[2] (5th)	MBCL
Sept. 1	5:05 a.m.	56	73	74	75	76	76	75	--	74
	5:35 a.m.	Start of precooling								
	6:05 a.m.	56	67	72	71	59	67	69	--	73
	7:05 a.m.	58	69	70	67	55	62	64	--	69
	9:05 a.m.	67	65	64	61	51	57	58	--	62
	11:05 a.m.	75	62	61	57	50	55	55	--	58
	1:05 p.m.	81	61	58	54	50	53	53	--	55
	5:05 p.m.	75	56	54	50	49	51	50	--	51
	9:05 p.m.	63	53	51	47	48	49	47	--	48
		End of precooling (16 hours) (See fig. 7 and ice meltage record below)								

Test 10. Ice meltage during precooling recorded as pounds of water collected from bunker drains and weighed hourly.

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
A-end	161	203	188	203	215	207	214	217	177	187	190	156	174	146	132	141	2911
B-end	163	180	194	201	208	219	203	207	183	183	175	153	178	140	132	137	2856
Total pounds	324	383	382	404	423	426	417	424	360	370	365	309	352	286	264	278	5767

1/ Thermocouple in 6th layer of cartons.

2/ Thermocouple in 5th layer.

Table 3. Precooling temperatures (°F.) of Navel oranges in fiberboard cartons in central California. Temperatures obtained by thermocouples inserted in fruit.

Test 11. Dry car, cooled-in-car by 4 fans in hatches.
No fans, no wall flues, wood floor racks.
Vented cartons (LV-3V), with collars.
Chimney load, 2 rows of 4-unit chimneys, center rows loose.
Loaded at Sunflower, Dec. 4.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec.													
4	3:30 p.m.	53	62	52	70	72	70	70	72	71	70	70	69
	3:45 p.m.	Start of precooling											
	4:00 p.m.	52	52	59	64	70	67	63	68	68	67	67	66
	5:00 p.m.	51	49	58	58	67	65	57	64	66	64	64	63
	10:00 p.m.	43	42	52	45	56	57	44	52	55	51	53	52
	11:00 p.m.	42	40	50	43	55	55	43	50	54	49	52	51
	11:45 p.m.	38	39	49	42	53	55	42	49	53	47	51	50

End of precooling (8 hours) (See fig. 8)

Test 12. Dry car, cooled-in-car by car fans.
Floor fans (1-HP motors), wall flues, metal floor racks.
T-load, vented cartons (LV-3V), with collars.
Loaded at Sunland, Dec. 7.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec.													
7	2:00 p.m.	52	61	54	68	72	69	66	68	68	68	65	65
	4:30 p.m.	51	65	55	69	71	69	67	68	68	65	65	64
	5:15 p.m.	--	53	57	--	72	--	--	68	--	--	65	--
	5:15 p.m.	Start of precooling											
	7:45 p.m.	46	49	54	68	70	67	58	66	66	63	63	63
	11:30 p.m.	44	48	52	67	68	64	54	65	64	56	61	63
8	12:30 a.m.	44	46	51	67	68	64	54	65	64	55	61	62

End of precooling (7+ hours) (See fig. 8, also transit temperature table 4 and fig. 12)

Table 3. con't.. Precooling temperatures (°F.) of Navel oranges continued.

Test 13. Preiced car, cooled-in-car 7+ hours by car fans.
Floor fans (1-HP motors), no flues, metal floor racks.
T-load, vented cartons (LV-3V), with collars.
Loaded at Sunland, Dec. 7.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec.													
7	2:00 p.m.	52	62	35	60	64	58	66	68	68	67	66	65
	4:30 p.m.	51	63	35	61	63	57	65	68	66	66	66	64
	5:15 p.m.	--	38	43	--	62	--	--	67	--	--	66	--
	5:15 p.m.	Start of precooling											
	7:45 p.m.	46	37	42	56	61	55	58	61	59	60	65	63
	11:30 p.m.	44	37	41	52	58	52	50	58	56	54	63	61
8	12:30 a.m.	44	37	41	51	57	51	49	58	56	53	62	60

End of precooling (7+ hours) (See fig. 8 also transit temperature table 4 and fig. 13).

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Test 14. Dry car, cooled-in-car by car fans.
Floor fans (1-HP motors), wall flues, metal floor racks.
T-load, vented cartons (LV-3V), with collars.
Loaded at Strathmore, Dec. 8.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec.													
8	4:40 p.m.	55	66	54	69	71	69	71	76	70	69	73	71
	7:00 p.m.	Start of precooling											
	8:15 p.m.	46	44	50	65	68	68	64	74	66	61	71	68
9	12:20 a.m.	43	41	46	54	63	65	54	69	63	55	68	64
	1:20 a.m.	42	41	45	51	61	64	52	68	60	53	66	62

End of precooling ($6\frac{1}{2}$ hours) (See fig. 8 also transit temperature table 4 and fig. 14).

Table 3 con't. Precooling temperatures (°F.) of Navel oranges con't.

<u>Test 15.</u> Dry car, cooled-in-car by 4 fans in hatches.
Electric fans, wall flues, metal floor racks.
T-load, vented cartons (LV-3V), with collars.
Loaded at Strathmore, Dec. 8.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec.													
8	5:00 p.m.	53	69	57	74	77	70	71	72	69	78	81	79
	8:25 p.m.	44	66	52	75	77	68	71	71	67	76	80	75
	10:00 p.m.	Start of precooling											
9	12:15 a.m.	43	42	45	52	66	60	56	65	62	65	73	71
	1:25 a.m.	42	41	44	47	62	58	51	63	61	61	71	69
		End of precooling (3½ hours) (See fig. 9)											

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<u>Test 16.</u> Dry car, cooled-in-car by car fans.
Floor fans (1-HP motors), no wall flues, wood floor racks.
Vented cartons (LV-3V), with collars.
Chimney load, 3 rows of 4-unit chimneys.
Loaded at Strathmore, Dec. 8.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec.													
8	4:30 p.m.	56	63	49	73	76	76	73	75	73	78	73	76
	5:00 p.m.	Start of precooling											
	5:30 p.m.	47	49	53	72	75	74	65	74	72	72	72	74
	8:30 p.m.	42	40	45	65	71	70	47	69	68	51	65	65
9	12:30 a.m.	40	41	47	64	70	68	44	66	66	45	58	63
	1:10 a.m.	40	40	44	61	68	65	40	61	63	42	55	59
		End of precooling (8 hours) (See fig. 9)											

Table 3 con't. Precooling temperatures (°F.) of Navel oranges continued.

Test 17. Dry car, cooled-in-car for 2 nights by 2 hatch fans.
Floor fans (1-HP motors), no wall flues, wood floor racks.
T-load, vented cartons (LV-3V) with collars.
Loaded at Lindsay, Dec. 9.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec. 9	10:40 a.m.	51	61	44	74	71	74	78	78	78	80	79	90
	2:00 p.m.	59	58	61	69	73	71	71	74	77	65	76	81
	2:00 p.m.	Start of precooling											
	3:00 p.m.	57	57	62	67	72	71	68	73	77	62	75	79
	5:00 p.m.	53	54	60	64	71	69	63	71	77	58	73	76
	8:50 p.m.	45	43	51	56	67	65	54	66	74	49	68	70
	11:00 p.m.	42	42	50	53	65	63	50	63	72	47	65	67
	11:00 p.m.	End of first precooling period (9 hours)											
10	12 Noon	Resumed precooling											
	6:00 p.m.	--	49	55	55	63	58	51	62	66	52	60	62
	9:00 p.m.	--	47	52	53	61	56	49	60	65	49	57	60
		End of second precooling period (9 hours) (See fig. 9).											

Test 18. Dry car, cooled-in-car by car fans
Floor fans (1-HP motors), no wall flues, metal floor racks.
Vented cartons (CCA7), no collars.
Channel load with 2-inch fiberboard spreaders.
1/ Loaded at Orange Cove, Dec. 10.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec. 10	4:00 p.m.	Start of precooling											
	4:05 p.m.	47	57	61	67	75	68	67	76	73	76	76	73
	7:35 p.m.	48	51	59	60	75	68	63	75	70	72	74	73
	11:00 p.m.	43	47	55	55	74	67	59	72	66	65	72	72
	11:55 p.m.	43	45	55	54	73	67	58	71	65	63	72	71
		End of precooling (8 hours). (See fig. 10)											

1/ Car fans started 8:00 a.m., ran during loading and continued during precooling.

Table 3 con't. Precooling temperatures (°F.) Navel oranges continued.

Test 19. Preiced car, cooled-in-car by car fans.
Floor fans (1-HP motors), no wall flues, metal floor racks.
Vented cartons (CCA7), no collars.
Channel load with 2 inch fiberboard spreaders.
Loaded at Orange Cove, Dec. 10.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec. 10	3:45 p.m.	47	62	40	67	68	62	69	75	67	73	77	73
	3:50 p.m.	Start of precooling											
	7:30 p.m.	48	44	50	61	66	61	50	72	65	68	76	71
	10:50 p.m.	44	43	50	57	65	60	46	69	63	63	74	68
	11:50 p.m.	43	43	50	56	65	59	46	69	63	64	74	67
		End of precooling (8 hours) (See fig. 10)											

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Test 20. Dry car, cooled-in-car by car fans.
Floor fans ($1\frac{1}{2}$-HP motors), no wall flues, wood floor racks.
Creeks T-load, vented cartons (LV-3V), with collars.
Loaded at Sunland, Dec. 11.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec. 11	4:00 p.m.	54	66	58	72	67	69	68	75	75	71	74	73
	4:00 p.m.	Start of precooling											
	9:00 p.m.	44	46	58	56	64	57	59	73	67	54	69	69
	9:15 p.m.	44	46	58	56	64	57	59	73	66	53	69	69
		End of precooling (5 hours) (See fig. 10)											

Table 3 con't. Precooling temperatures (°F.) of Navel oranges continued.

Test 21. Dry car, cooled-in-car by car fans.
Floor fans, (1½-HP motors), no wall flues, wood floor racks.
Creeks T-load, vented cartons (LV-3V), with collars.
Loaded at Sunland, Dec. 11.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec. 11	4:00 p.m.	54	67	52	72	73	68	71	74	72	73	69	70
	4:15 p.m.		Start of precooling										
	9:10 p.m.	44	48	52	68	72	61	57	68	70	63	67	67
	11:25 p.m.	44	46	50	66	70	59	52	65	67	58	65	65
	12:15 a.m.	45	48	51	66	70	58	51	65	67	58	65	64

End of precooling (8 hours) (See fig. 10, also transit temperature table 4 and fig. 15)

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Test 22. Dry car, cooled-in-car by 4 fans in hatches.
Electric fans, no wall flues, wood floor racks.
Vented cartons, (LV-3V), with collars.
Channel load with 2x3 inch wood spreaders.
Loaded at Lindsay, Dec. 12.

Date	Time	OA	TA	BA	TBCL	MBCL	BBCL	TQCL	MQCL	BQCL	TDCL	MDCL	BDCL
Dec. 12	12 noon	54	56	48	77	79	75	72	73	63	89	73	81
	12:05 p.m.	Start of precooling											
	3:30 p.m.	57	57	61	64	74	72	61	71	65	71	73	78
	8:00 p.m.	44	43	53	54	70	67	53	69	57	59	72	76
	12:10 a.m.	41	40	48	46	66	63	46	66	53	53	69	73

End of precooling (12 hours) (See fig. 11, also transit temperature table 4 and fig. 16)

Table 4. Average daily temperatures (°F.) of Navel oranges in fiberboard cartons in transit to New York from central California. Temperatures obtained by means of recording thermometers within cartons.

Test 12. Dry car, cooled-in-car 7+ hours by car fans.
Floor fans (1-HP motors), wall flues, metal floor racks.
T-load, vented cartons (LV-3V), vents open to Belen.
Standard ventilation beyond.

Position	December 1/ 7	8	9	10	11	12	13	14	15	16	Average for trip
TQCL	67	63	59	50	46	44	43	42	42	42	51.3
MQCL	69	71	67	62	58	54	52	50	48	47	57.5
MQ wall	66	64	59	54	50	46	45	44	43	43	50.6
MDCL	68	64	61	56	52	49	47	45	45	43	54.8
OA	50	46	39	31	33	31	33	31	35	30	34.8

(See fig. 12 also precooling temp. table 3 and fig. 8)

Test 13. Preiced car, replenished, not reiced, precooled 7+ hours with car fans.
Floor fans (1-HP motors), no flues, metal floor racks.
T-load, vented cartons (LV-3V), with collars.

Position	December 1/ 7	8	9	10	11	12	13	14	15	16	Average for trip
TQCL	63	56	48	42	39	39	39	39	38	39	43.8
MQCL	66	66	63	59	54	52	50	49	47	46	54.9
MQ wall	67	63	58	51	47	45	42	42	42	40	48.9
MDCL	68	64	59	54	50	47	45	44	43	42	50.8
OA	50	46	39	31	33	31	33	31	35	30	34.8

(See fig. 13, also precooling temp. on table 3 and fig. 8)

Test 14. Dry car, cooled-in-car 6½ hours by car fans.
Floor fans,(1-HP motors), wall flues, metal floor racks.
T-loaded, vented cartons (LV-3V). Vents open to Belen
Standard ventilation beyond.

Position	December 1/ 8	9	10	11	12	13	14	15	16	17	Average for trip
TQCL	68	62	56	48	45	44	41	41	41	42	50.1
MQCL	79	72	67	61	57	54	52	50	50	48	58.1
MQ wall	78	71	65	56	51	48	46	45	43	43	53.6
MDCL	76	70	67	61	56	53	50	49	48	47	59.5
OA	53	48	42	26	36	39	33	23	26	23	34.0

(See fig. 14 and also precooling temp. table 3 and fig.8)

1/ Loading day

Table 4 con't. Average daily temperatures (°F.) of Navel oranges con't.

Test 21. Dry car, cooled-in-car 8 hours by car fans.
Floor fans, (1½-HP motors), no wall flues, wood floor racks.
Vented cartons (LV-3V), Creeks T-load.
Vents open to Belen, standard ventilation beyond.

Position	December [1/] 11	12	13	14	15	16	17	18	19	20	Average for trip
TQCL	69	56	53	46	43	44	44	44	43	42	46.8
MQCL	72	67	65	60	55	53	52	50	47	46	56.0
MQ wall	68	64	61	54	50	48	45	43	41	41	51.3
MDCL	76	--	Ryan failed to function							46	--
OA	55	47	46	32	35	11	12	18	30	39	31.1

(See fig. 15 and also precooling temp. table 3 and fig. 10)

Test 22. Dry car, cooled-in-car 12 hours by 4 hatch fans.
Electric fans, no wall flues, wood floor racks.
Vented cartons (LV-3V), with collars.
Channel load 2x3 inch wood spreaders.
Vents open to Ogden, standard ventilation beyond.

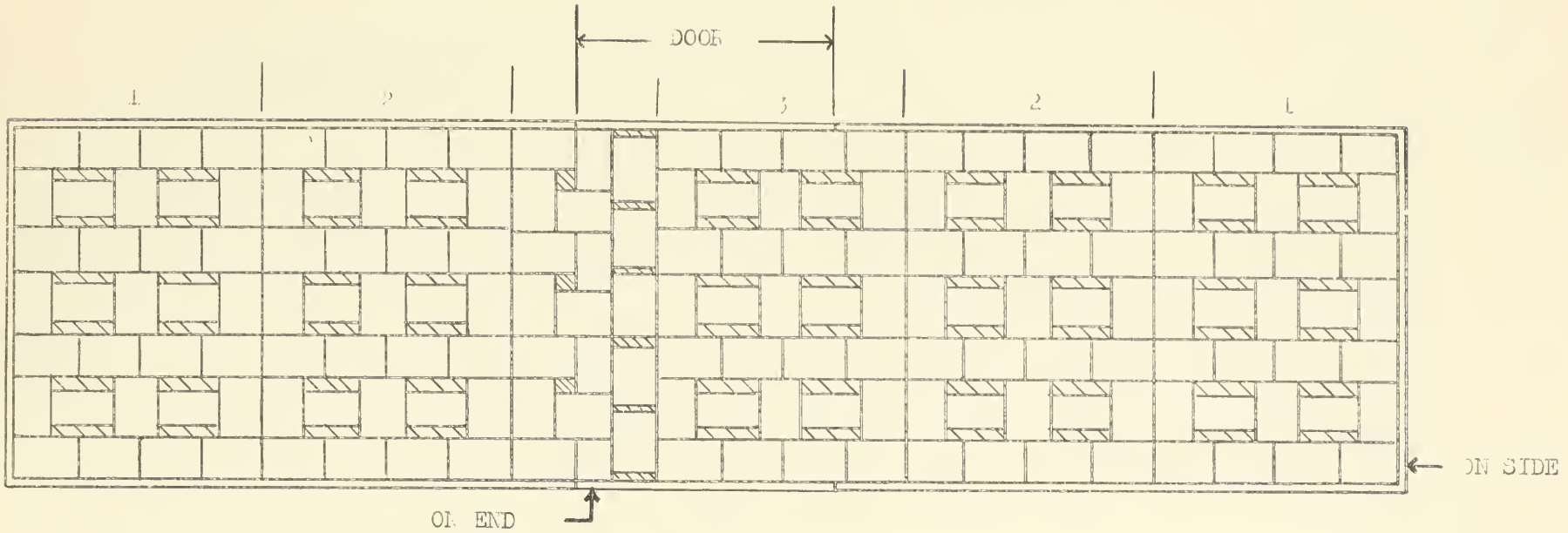
Position	December [1/] 12	13	14	15	16	17	18	19	20	21	Average for trip
TQCL	66	55	57	52	50	49	47	44	44	43	49.9
MQCL	74	66	65	61	58	55	52	49	48	47	57.0
MQ wall	72	64	62	58	55	53	51	48	47	46	54.9
MDCL	79	73	69	63	57	54	51	48	46	45	57.7
OA	52	49	37	32	26	16	18	26	37	41	31.9

(See fig. 16 and precooling temp. table 3 and fig. 11)

[1/] Loading day

Figure 1

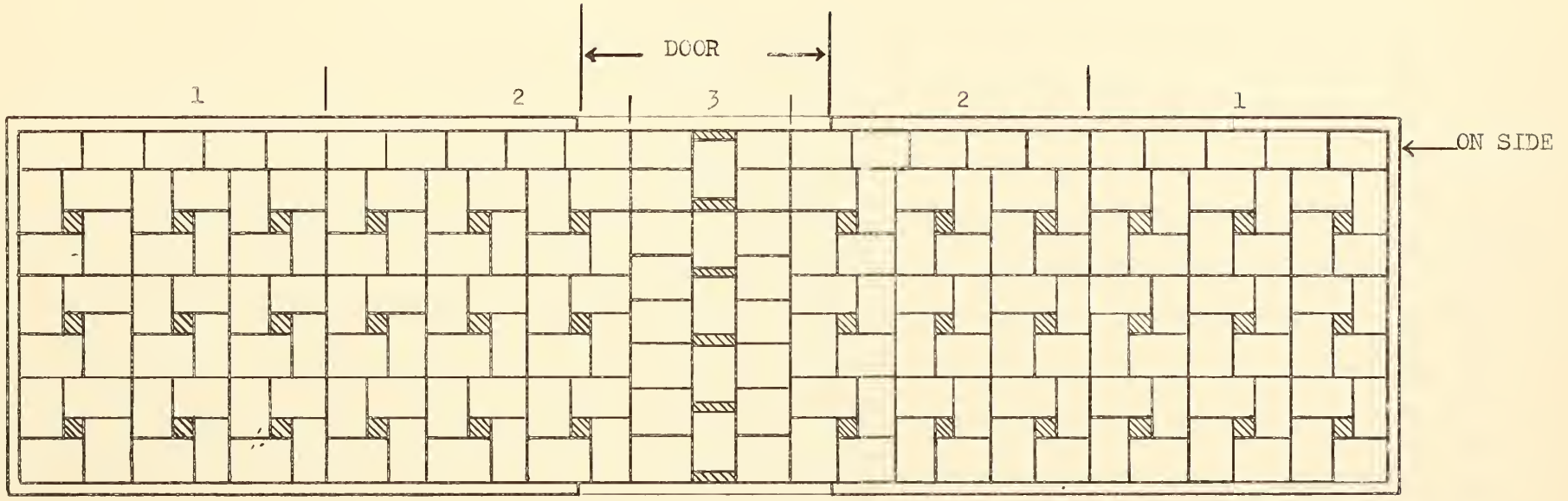
The "T" Load for Oranges



1042 cartons at 6 high
Total area of voids - 3400 square inches.
Area of cartons exposed to voids - 27% of total

Figure 2

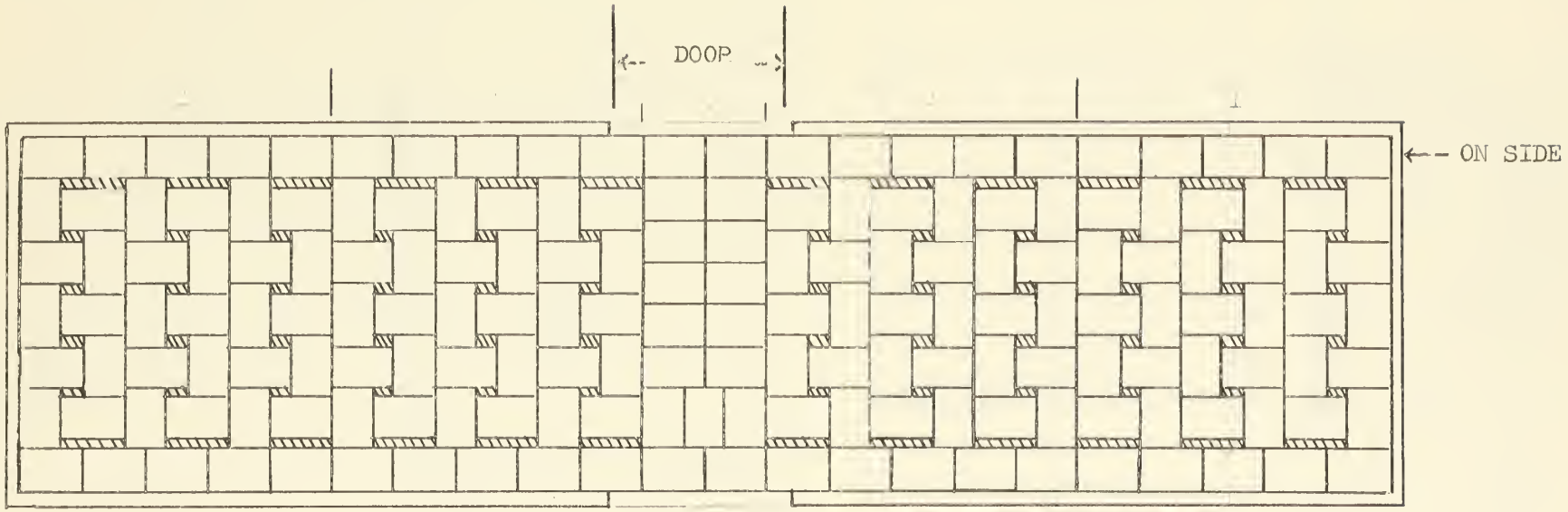
Chimney load for oranges



About 1040 cartons at 6 high
Total voids - 1400 square inches
Area of cartons exposed to chimneys - 10% of total.

Figure 3

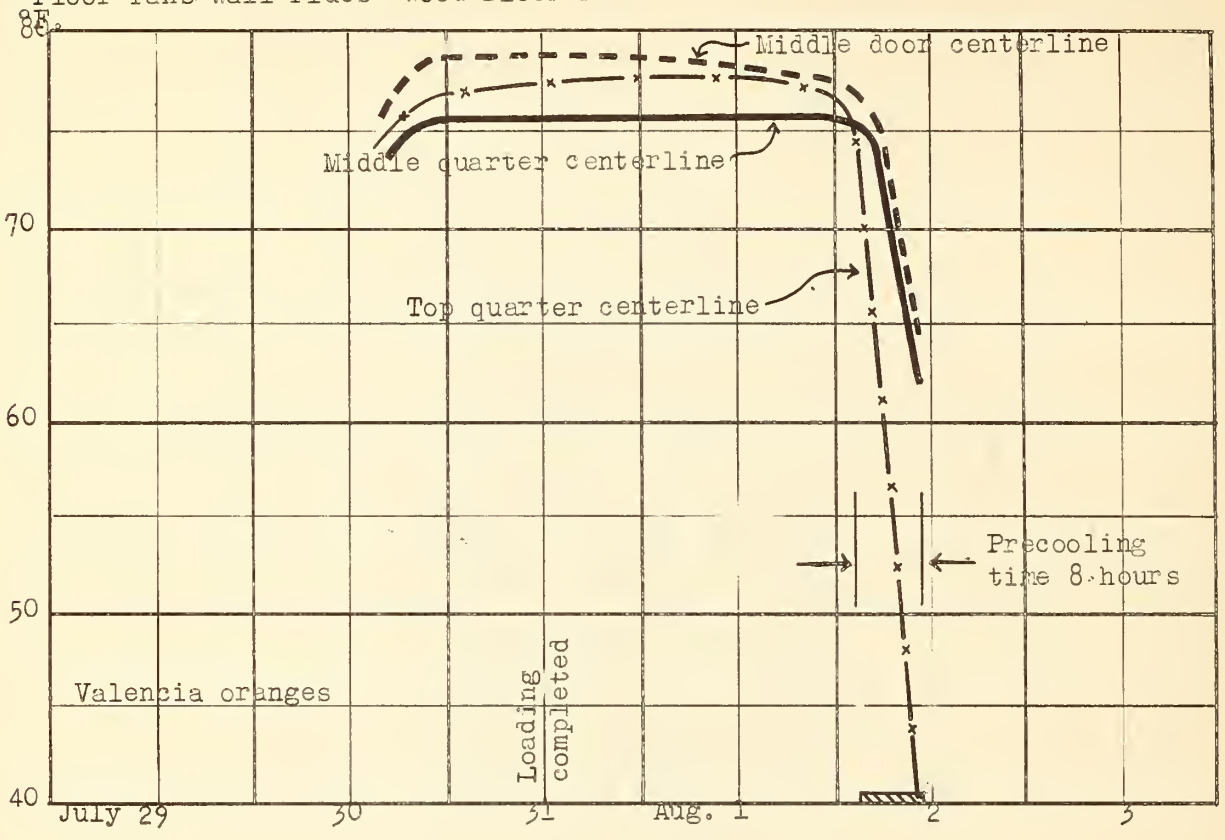
Crooks T Load



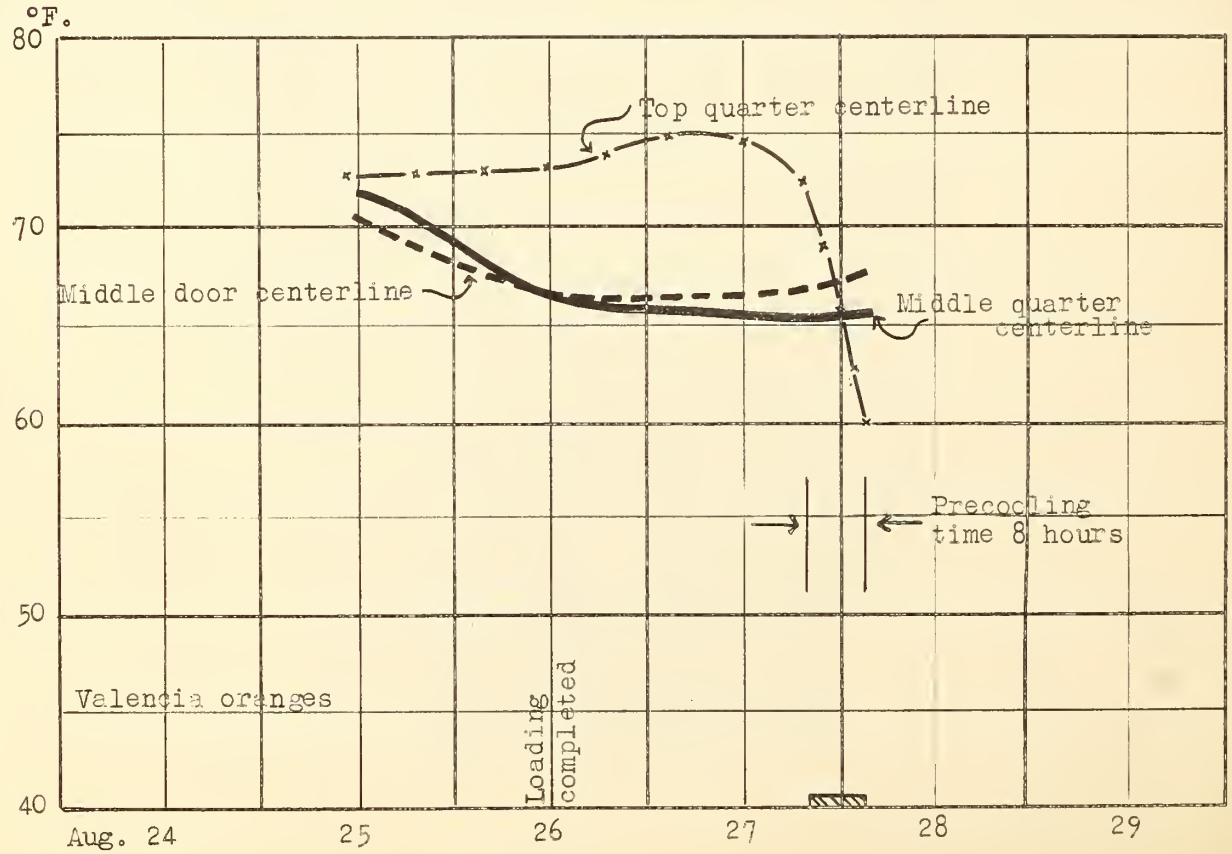
About 1045 cartons at 6 high
Total voids - 2160 square inches
Area of cartons exposed to chimneys - 18%.

Figure 4

Test 1. PI car-H.S.-Repl. by shipper-precooled by carrier-Channel load-½" spreaders Floor fans-wall flues- wood floor racks - vented cartons - no collars.



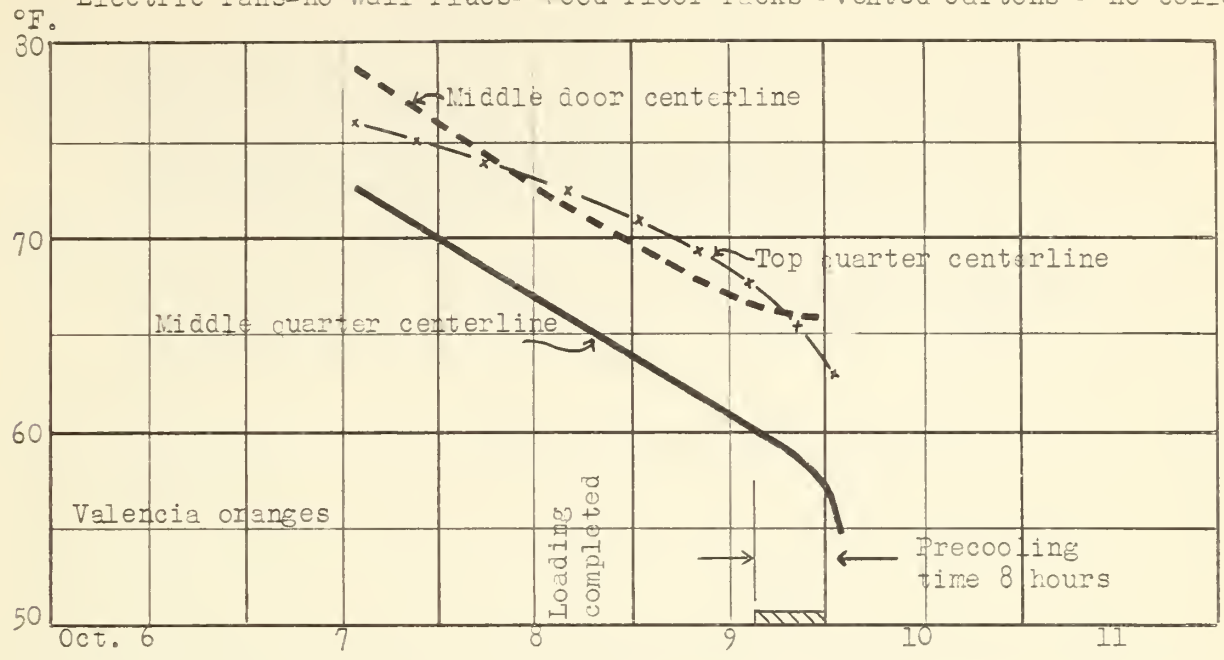
Test 2. PI car-H.S.-Repl. by shipper-precooled by carrier-Channel load-½" spreaders Electric fans-wall flues-metal floor racks- vented cartons - no collars.



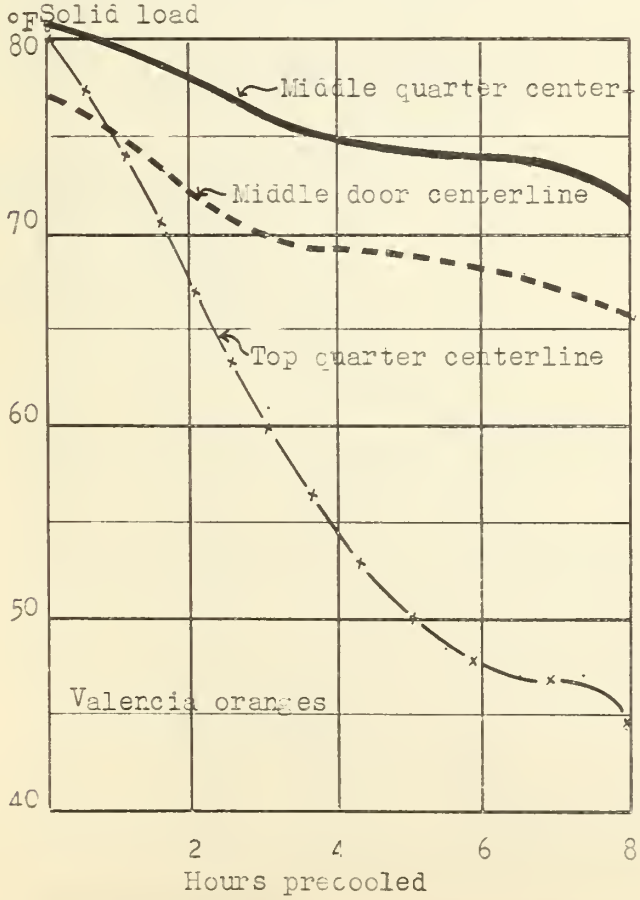
Temperatures taken by thermocouples.

Figure 5

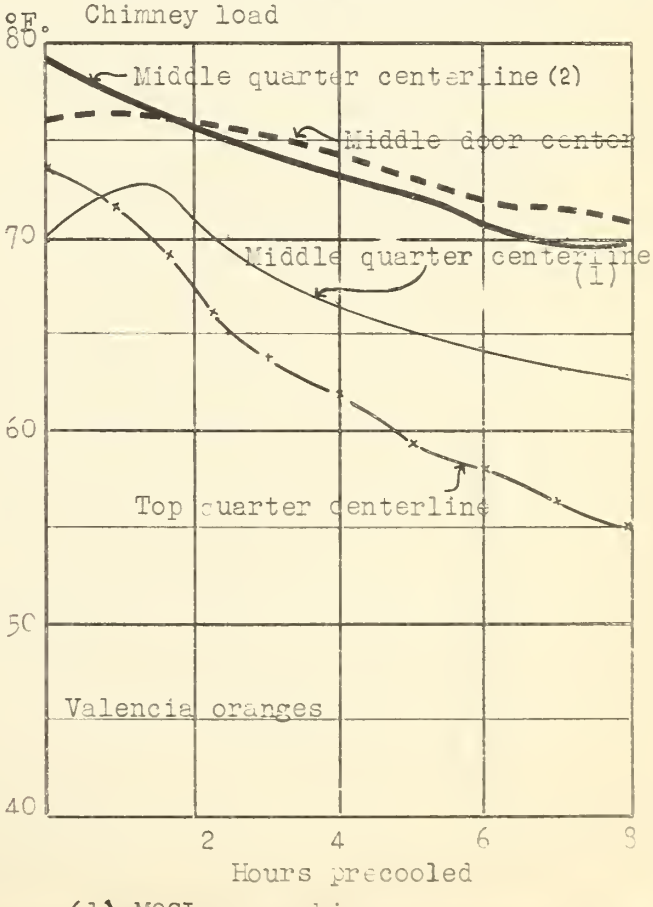
Test 3. PI car-H.S.-Repl. by shipper-precooled by carrier-Channel load-2" spreaders
Electric fans-no wall flues- wood floor racks -vented cartons - no collars.



Test 4. Dry car-precooled by carrier
Floor fans-flues - metal floor racks
Vented cartons , no collars
Solid load



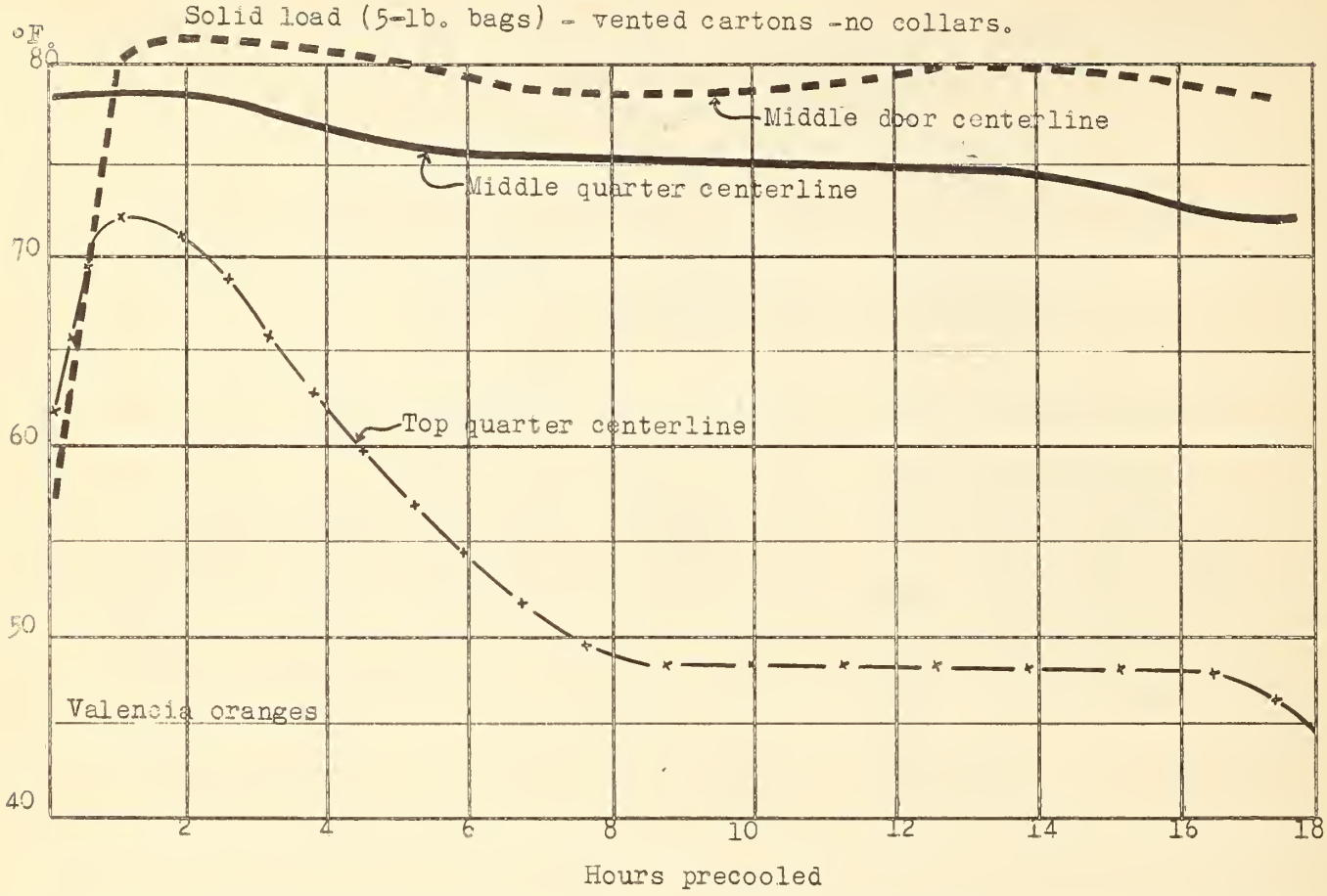
Test 5. Dry car-precooled by carrier
Floor fans-no flues-wood floor racks
Vented cartons with collars
Chimney load



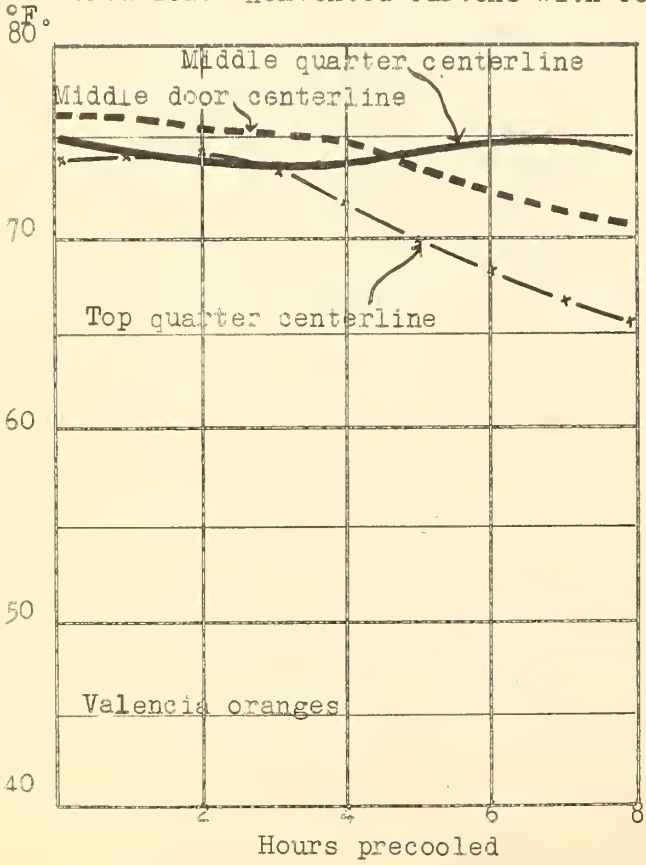
(1) MQCL near chimney
(2) MQCL away from chimney

Figure 6

Test 6. Dry car-initially iced before precooling by car fans.
Electric fans-wall flues-metal floor racks
Solid load (5-lb. bags) - vented cartons -no collars.



Test 7. Dry car-II after precooling by carrier
Electric fans-flues-metal floor racks
Solid load- nonvented cartons with collars.



Test 8. Dry car-II after PC by carrier
Electric fans-flues-metal floors
Chimney load-nonvented cartons with collars.

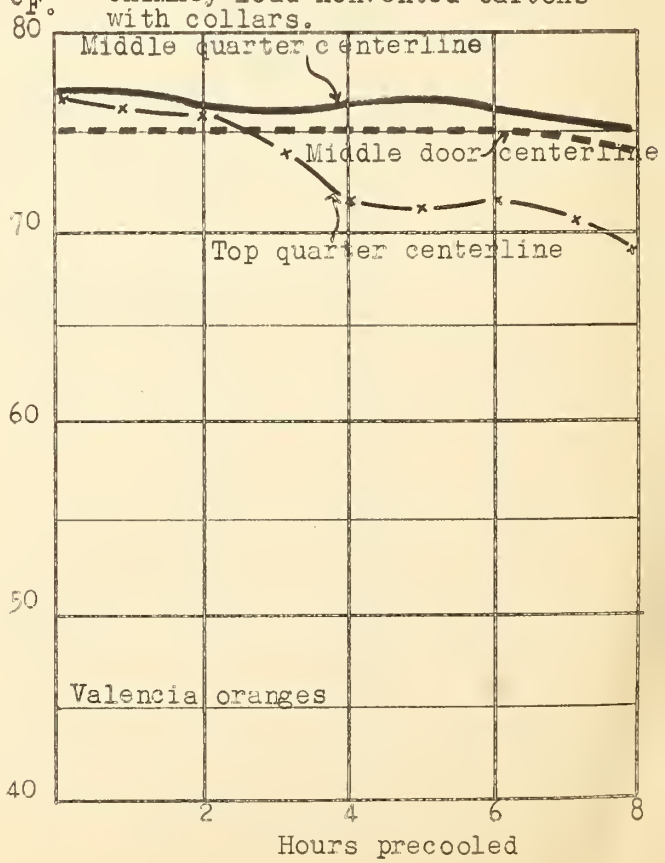
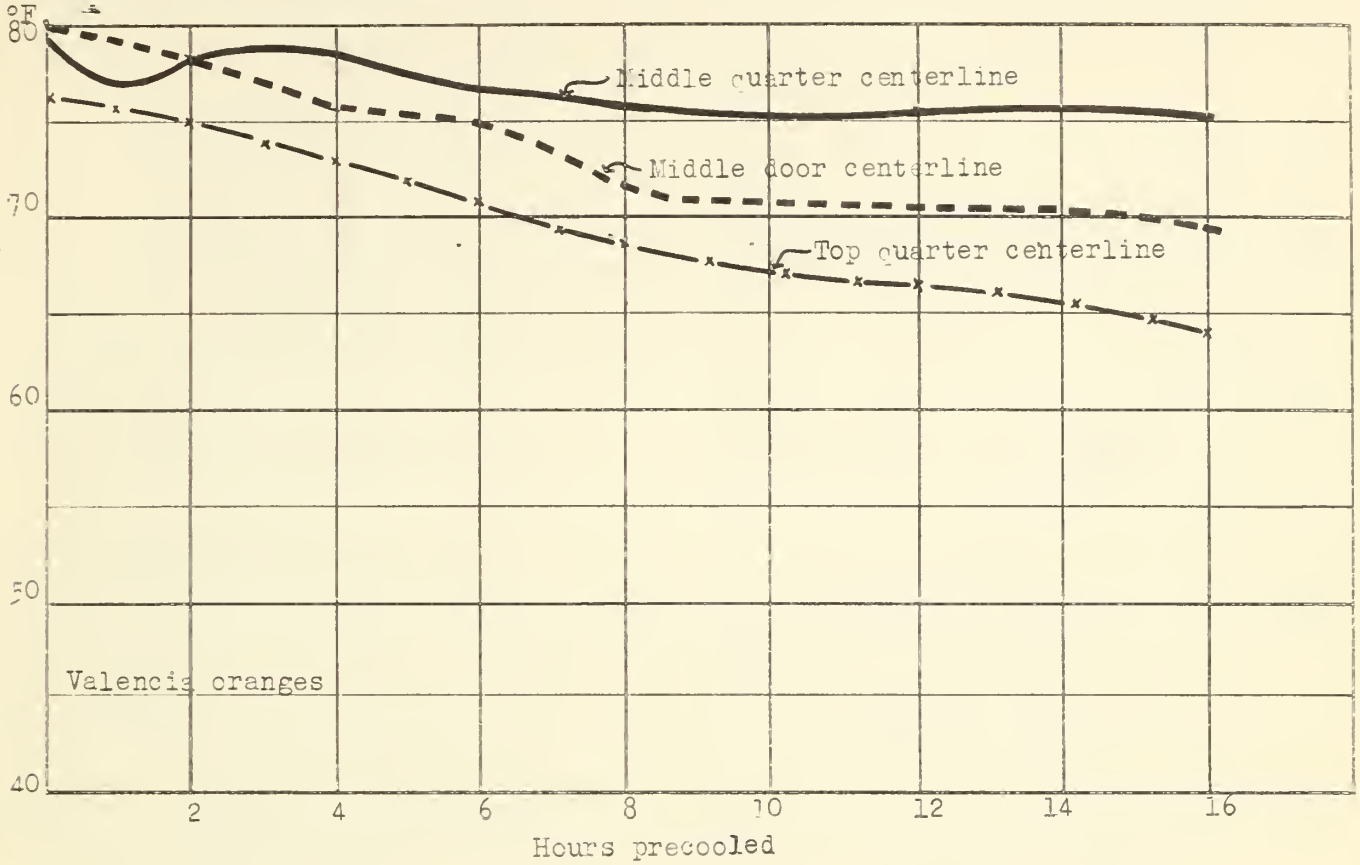
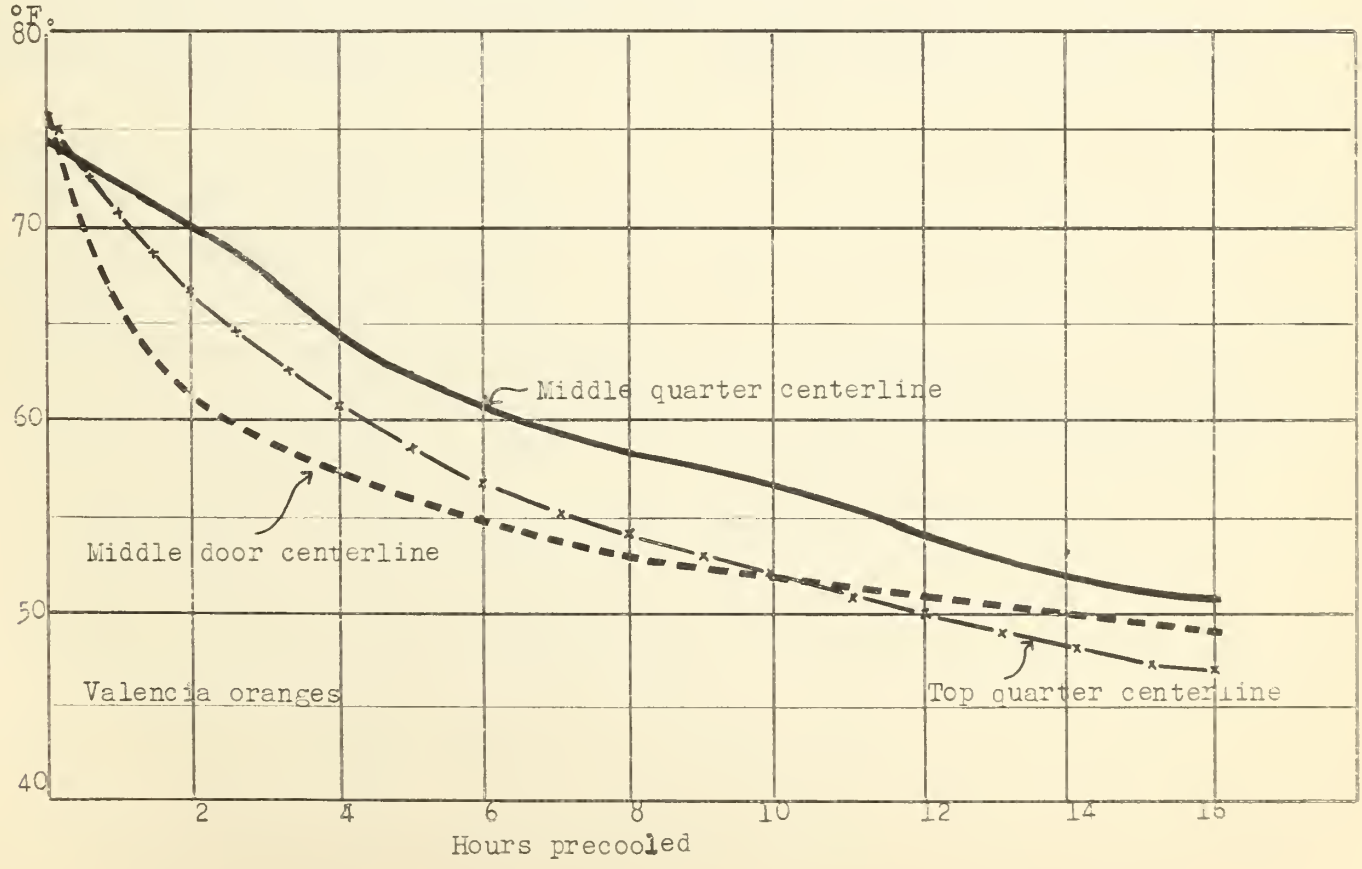


Figure 7

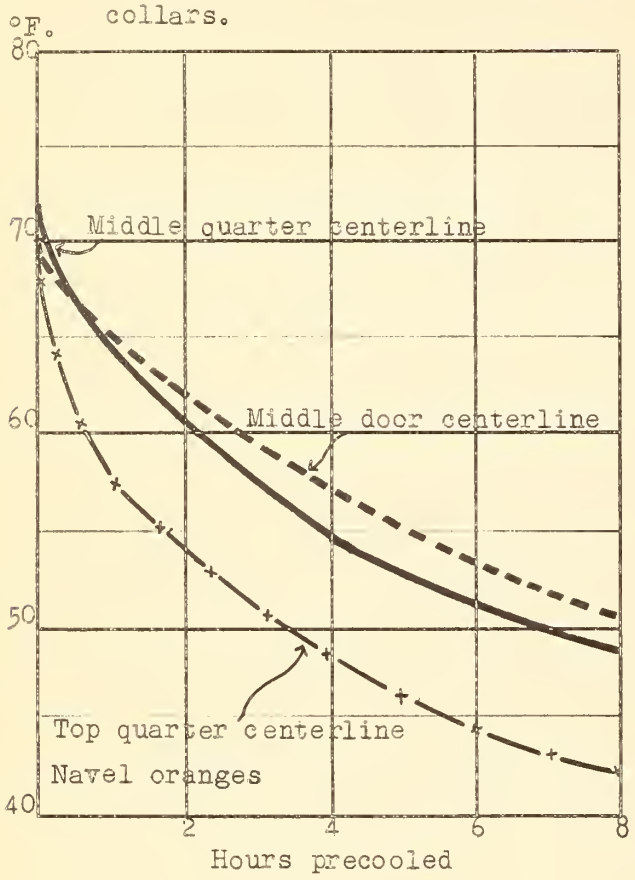
Test 9. Dry car-initially iced before precooling by car fans-Cross Channel-½" spreaders Preco electric fans-flues-metal floor racks-nonvented cartons with collars.



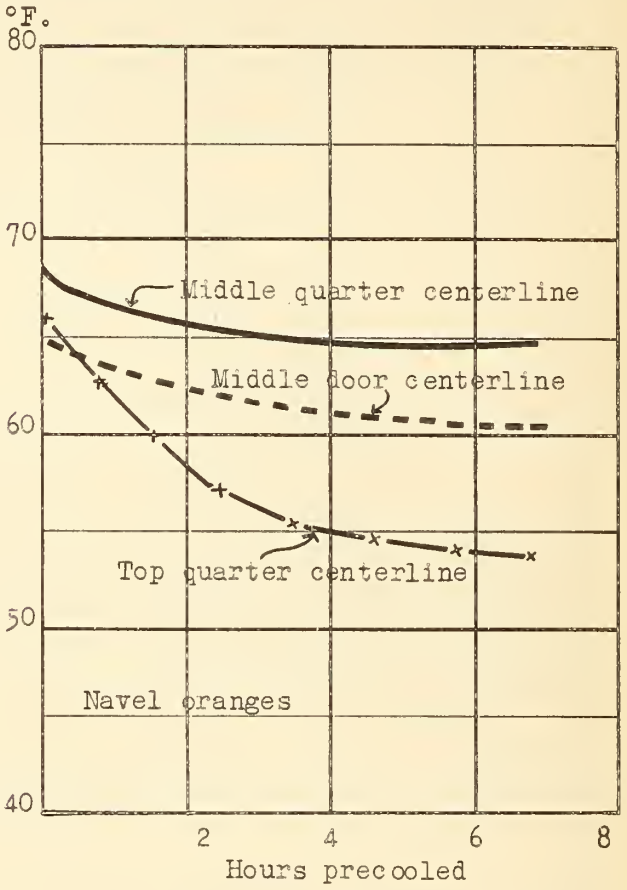
Test 10. Dry car-initially iced before precooling by car fans- standard box load. Preco electric fans-flues-metal floor racks.



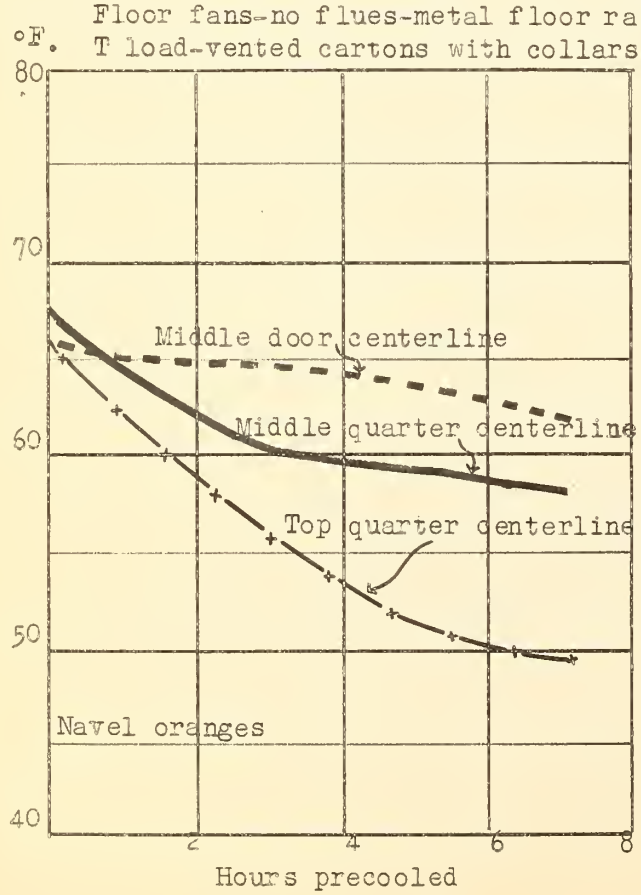
Test 11. Dry car-CIC by 4 hatch fans
No fans-no flues-wood floor racks
Chimney load-vented cartons with collars.



Test 12. Dry car-CIC by car fans & 1-HP motors
Floor fans-wall flues-metal floor racks
T load-vented cartons with collars.



Test 13. PI car-CIC by car fans & 1-HP motors
Floor fans-no flues-metal floor racks
T load-vented cartons with collars.



Test 14. Dry car-CIC by car fans & 1-HP motors
Floor fans-wall flues-metal floor racks
T load-vented cartons with collars.

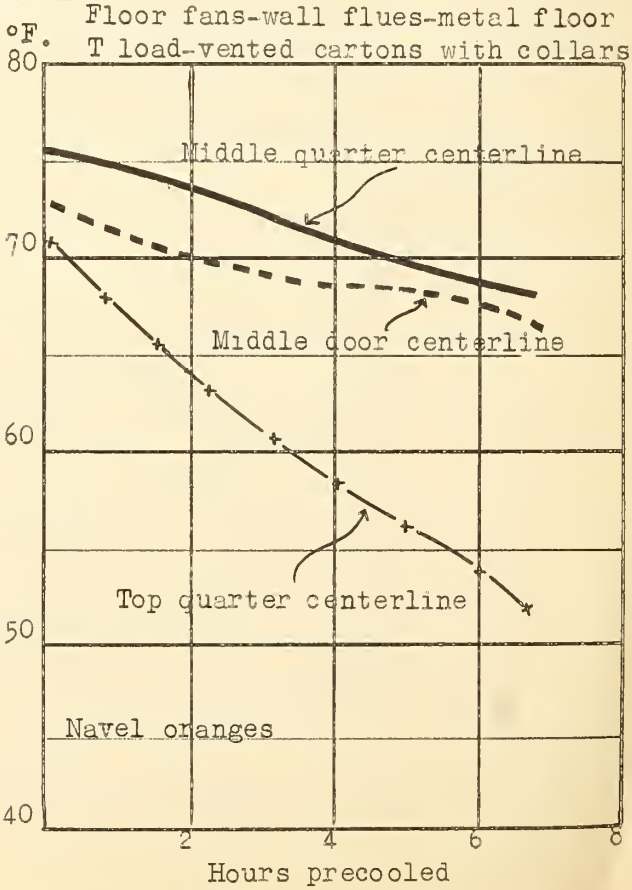
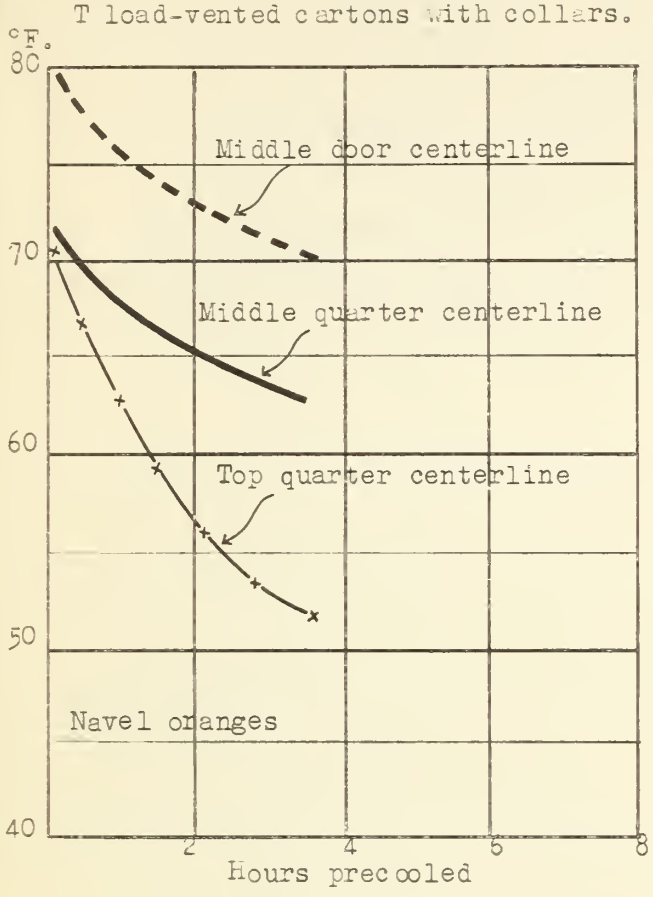
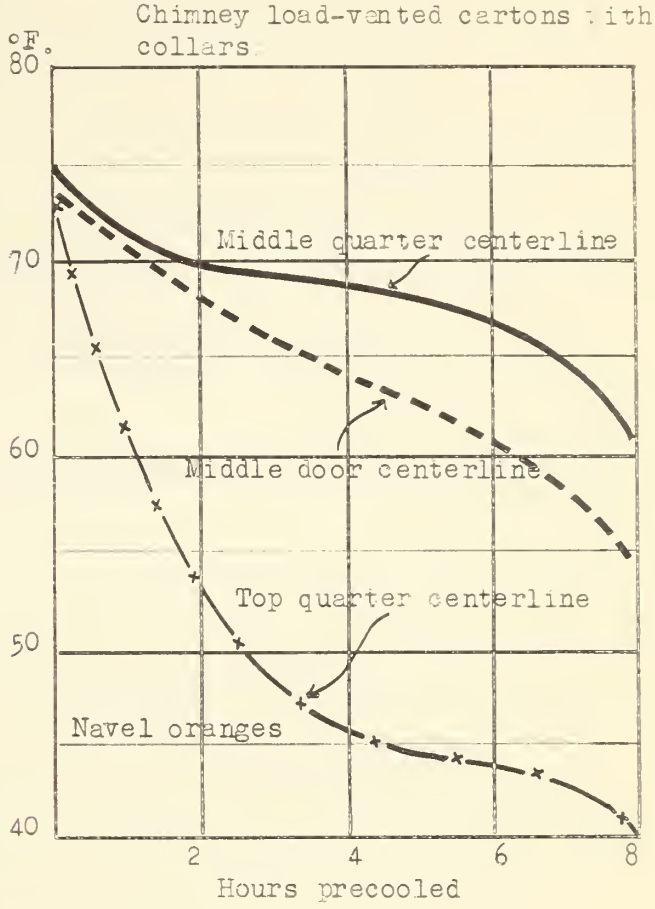


Figure 9

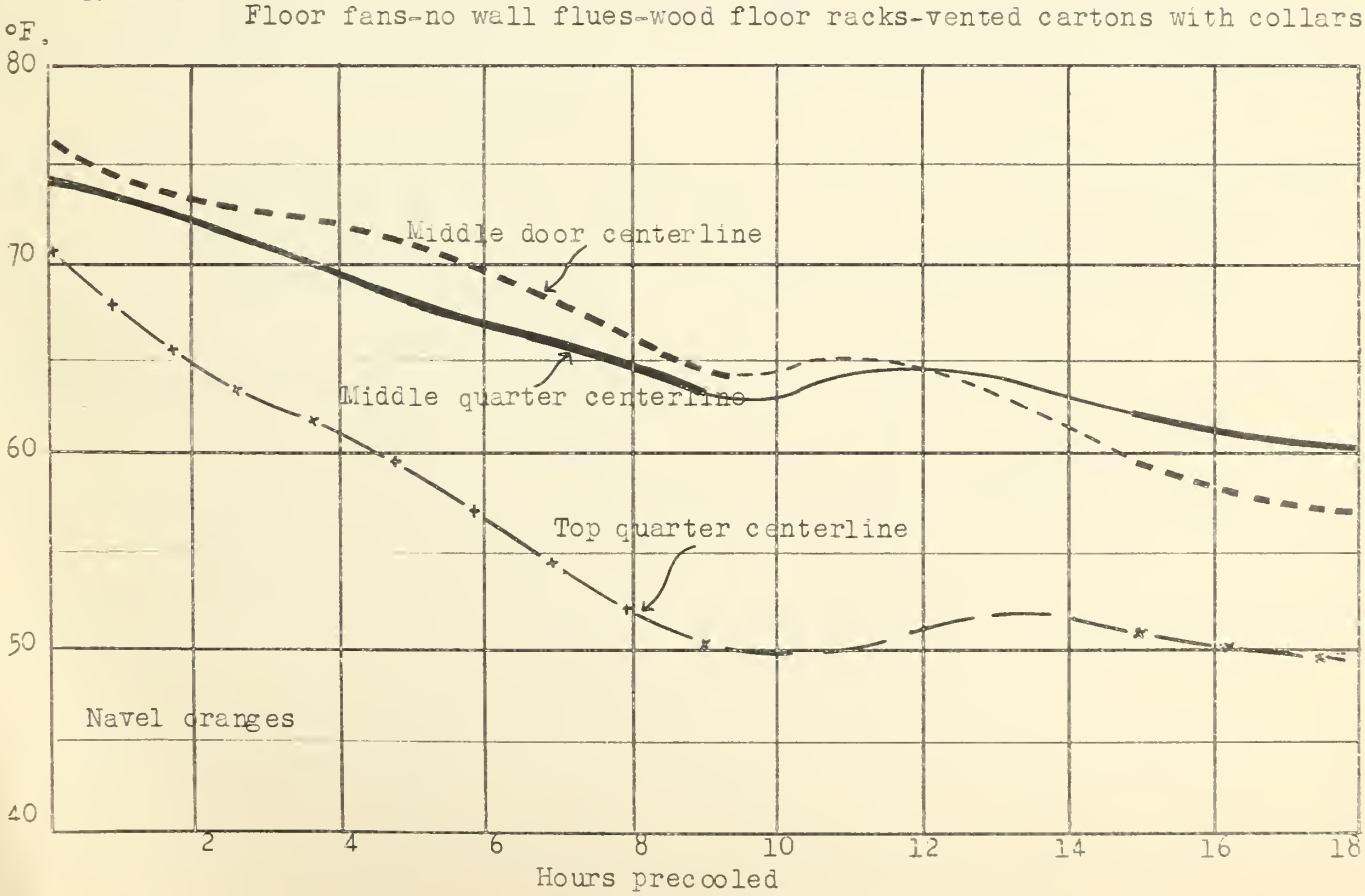
Test 15. Dry car-CIC by 4 fans in hatches
Electric fans-wall flues-metal floor racks
T load-vented cartons with collars.



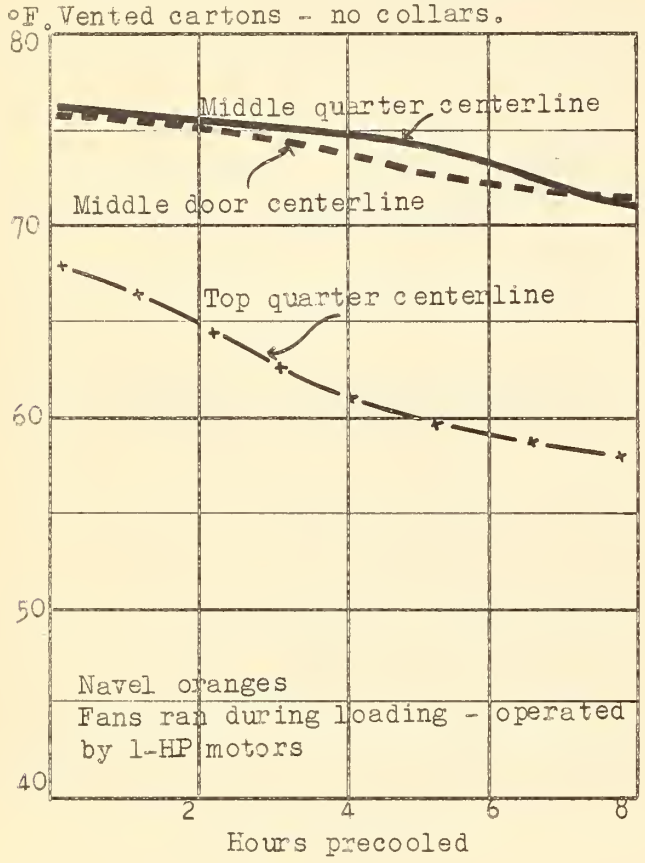
Test 16. Dry car-CIC by car fans & 1-HP motors
Floor fans-no flues-wood floor racks
Chimney load-vented cartons with collars.



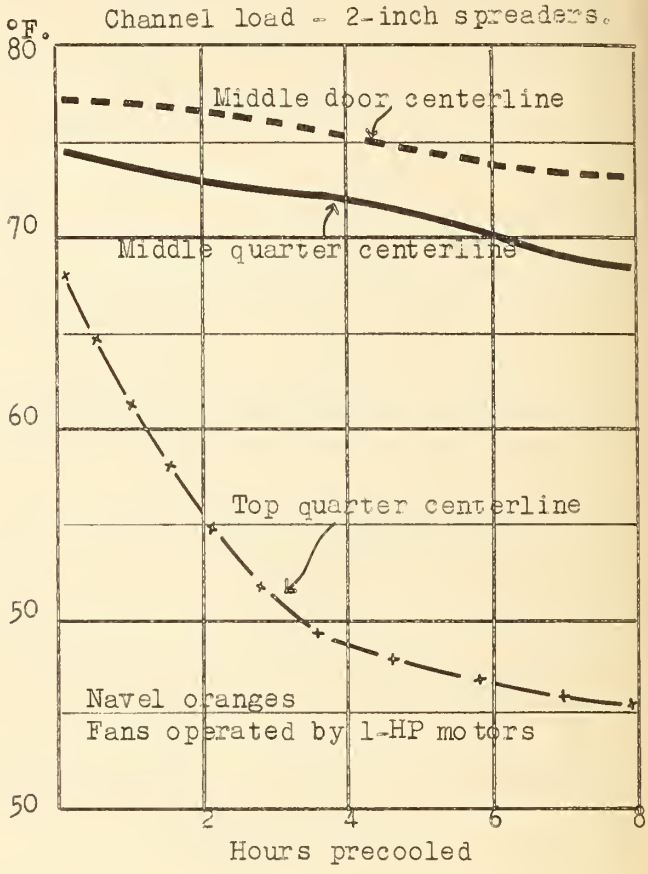
Test 17. Dry car-CIC by car fans with 1-HP motors and 2 hatch fans-T load
Floor fans-no wall flues-wood floor racks-vented cartons with collars.



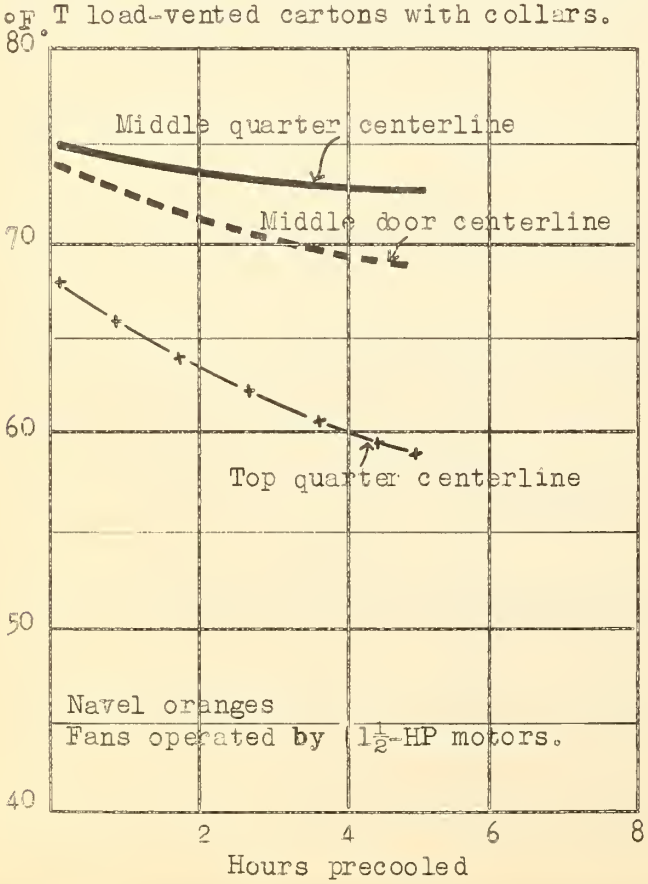
Test 18. Dry car-CIC by car fans
Floor fans-no flues-metal floor racks
Channel load - 2-inch spreaders.
Vented cartons - no collars.



Test 19. Preiced car-CIC by car fans
Floor fans-no flues-metal floor racks
Vented cartons - no collars
Channel load - 2-inch spreaders.



Test 20. Dry car-CIC by car fans
Floor fans-no flues-wood floor racks
T load-vented cartons with collars.



Test 21. Dry car-CIC by car fans
Floor fans-no flues-wood floor racks
T load-vented cartons with collars.

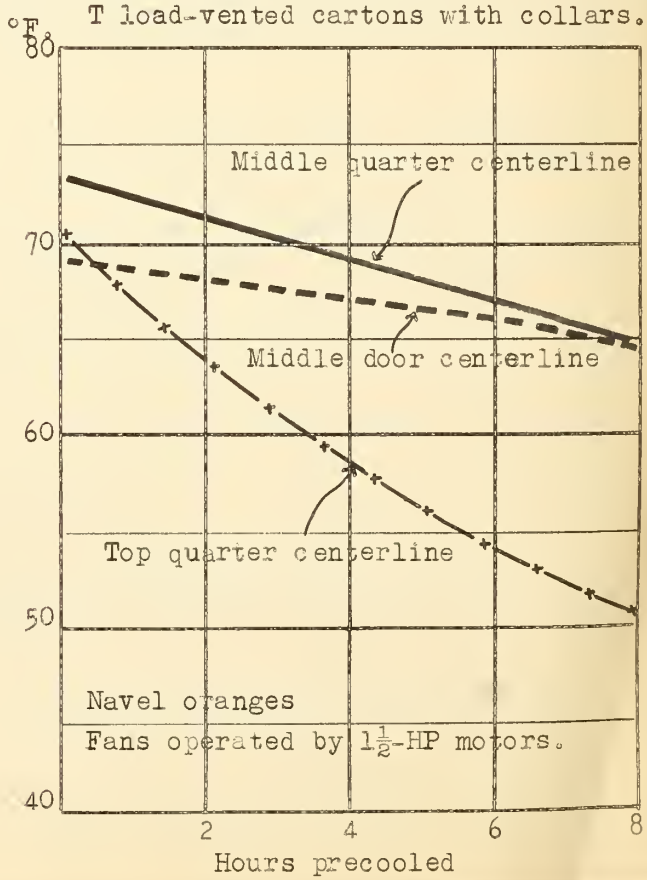


Figure 11

Test 22. Dry car—cooled in car by 4 hatch fans- Channel load(2-inch spreaders) Electric fans-no wall flues-wood floor racks-vented cartons with collars.

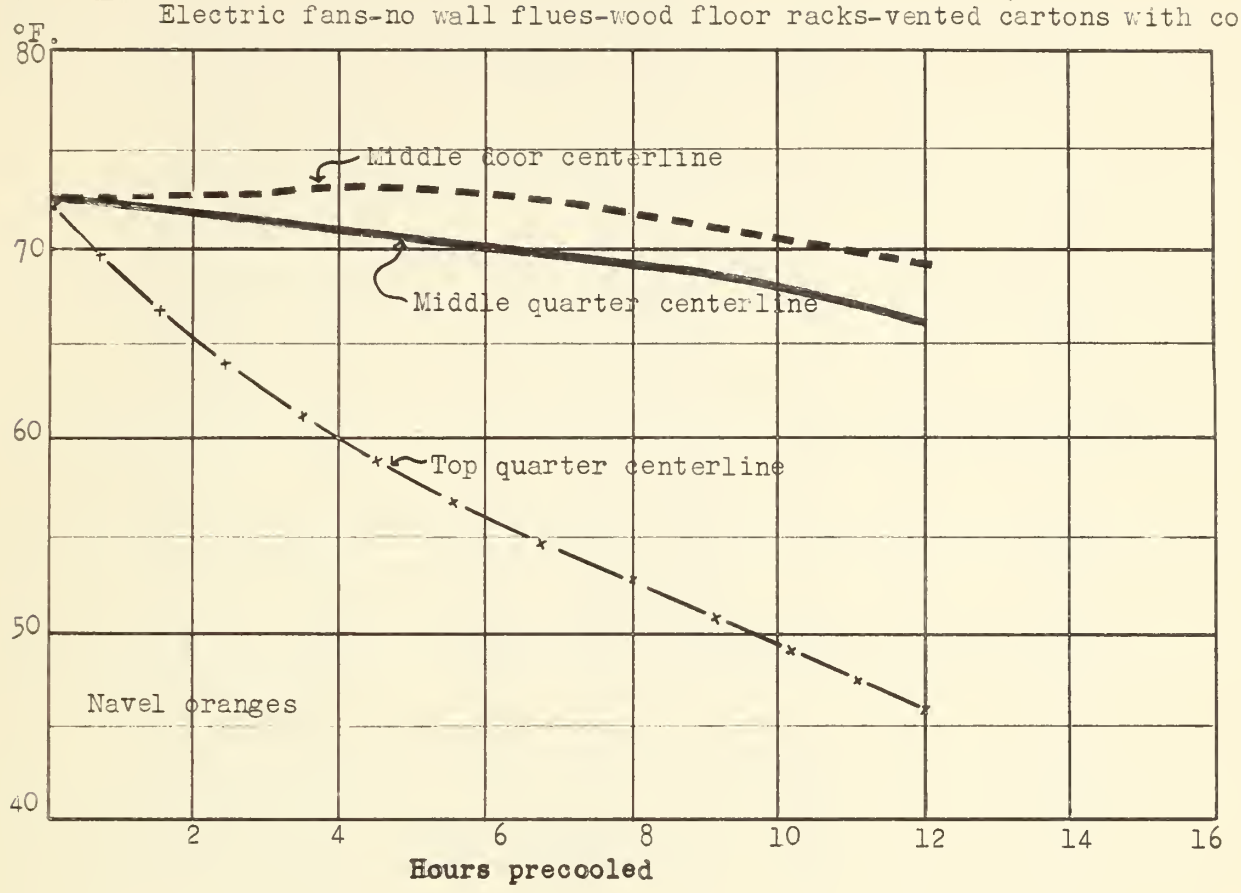


Figure 12 - Test 12 - Navel Oranges

Transit Temperatures by Ryan Thermometers

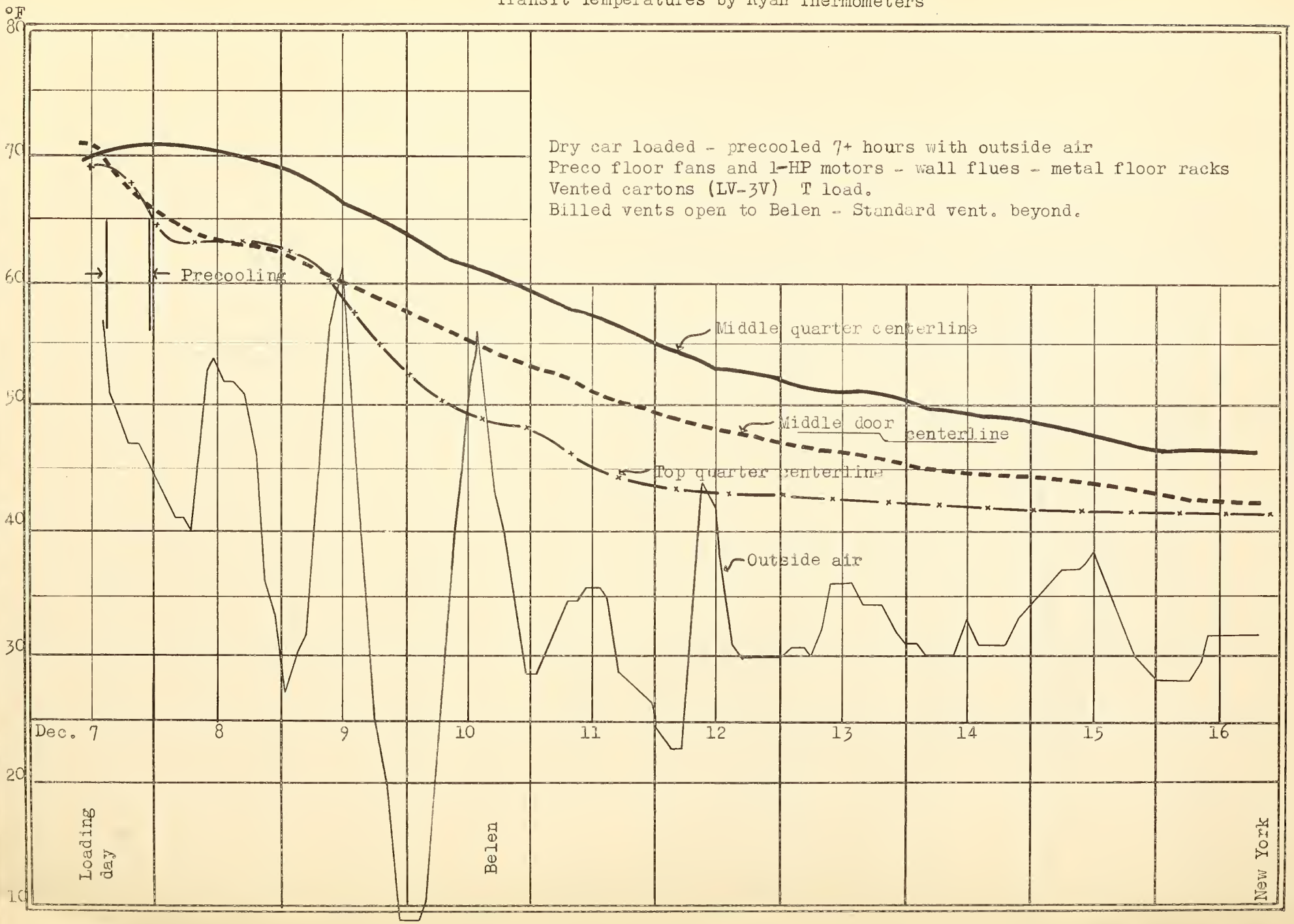


Figure 13 - Test 13 - Navel Oranges
Transit Temperatures by Ryan Thermometers

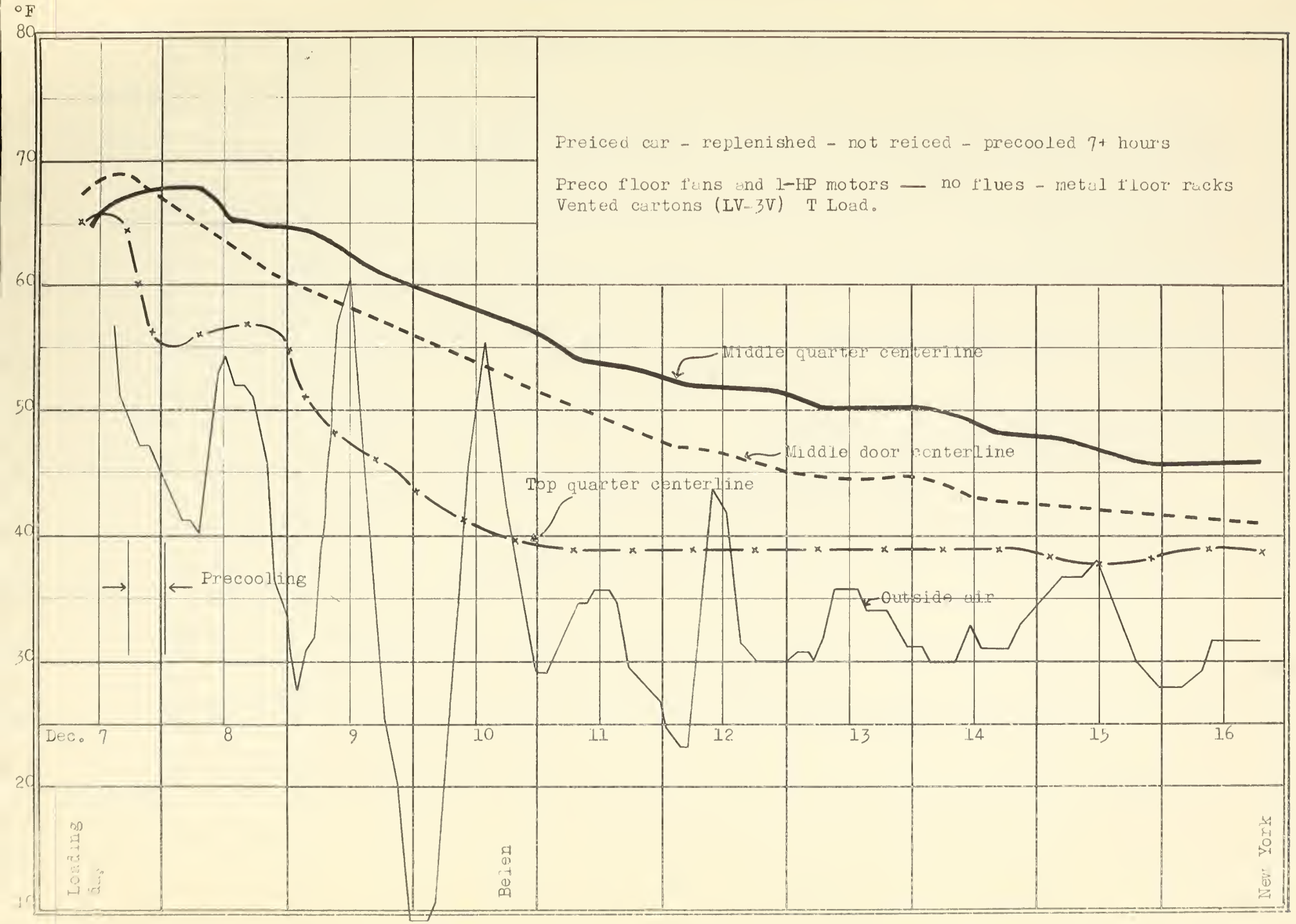


Figure 14 - Test 14 - Navel Oranges

Transit Temperatures by Ryan Thermometers

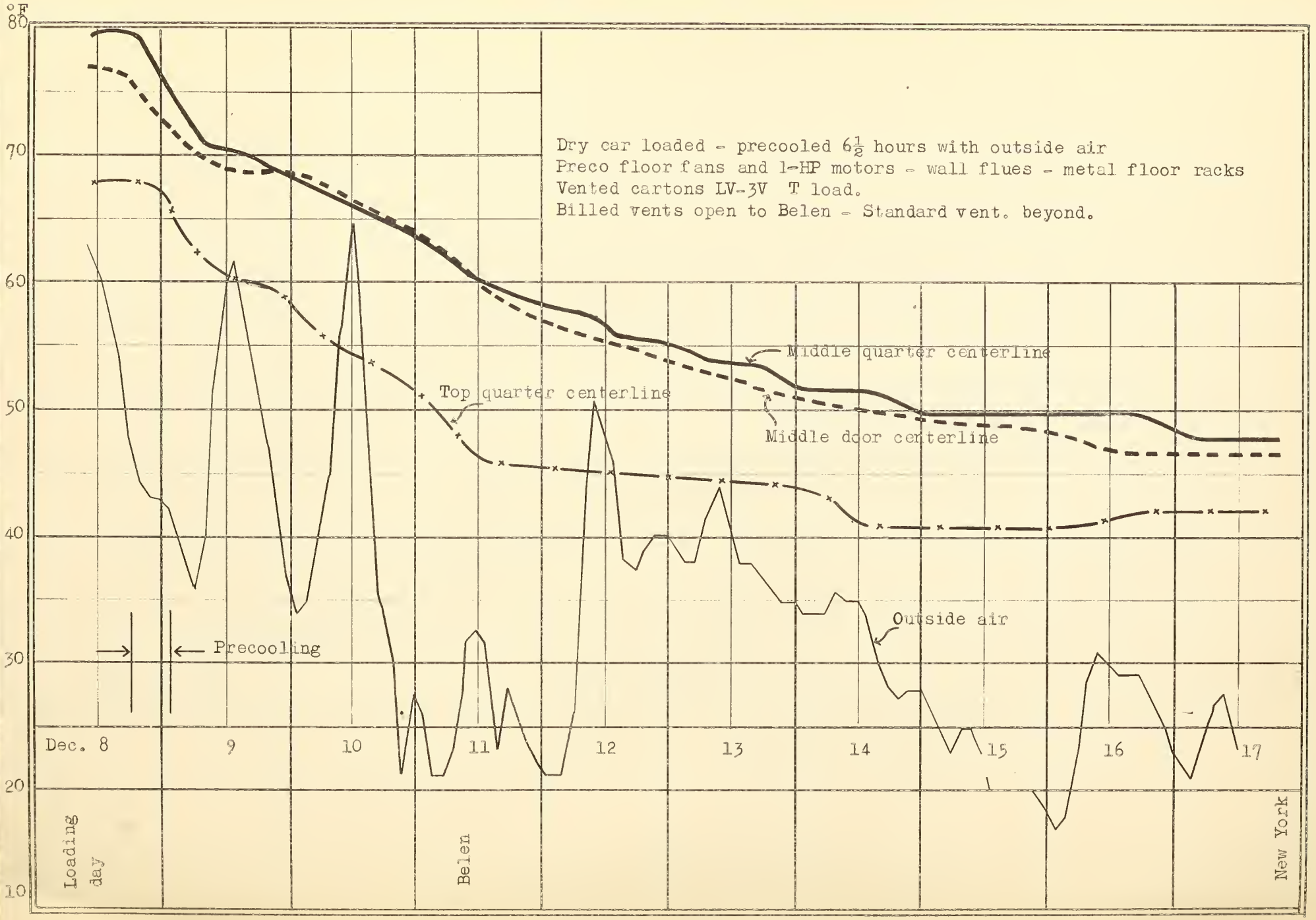


Figure 15 - Test 21 - Navel Oranges

Transit Temperatures by Ryan Thermometers

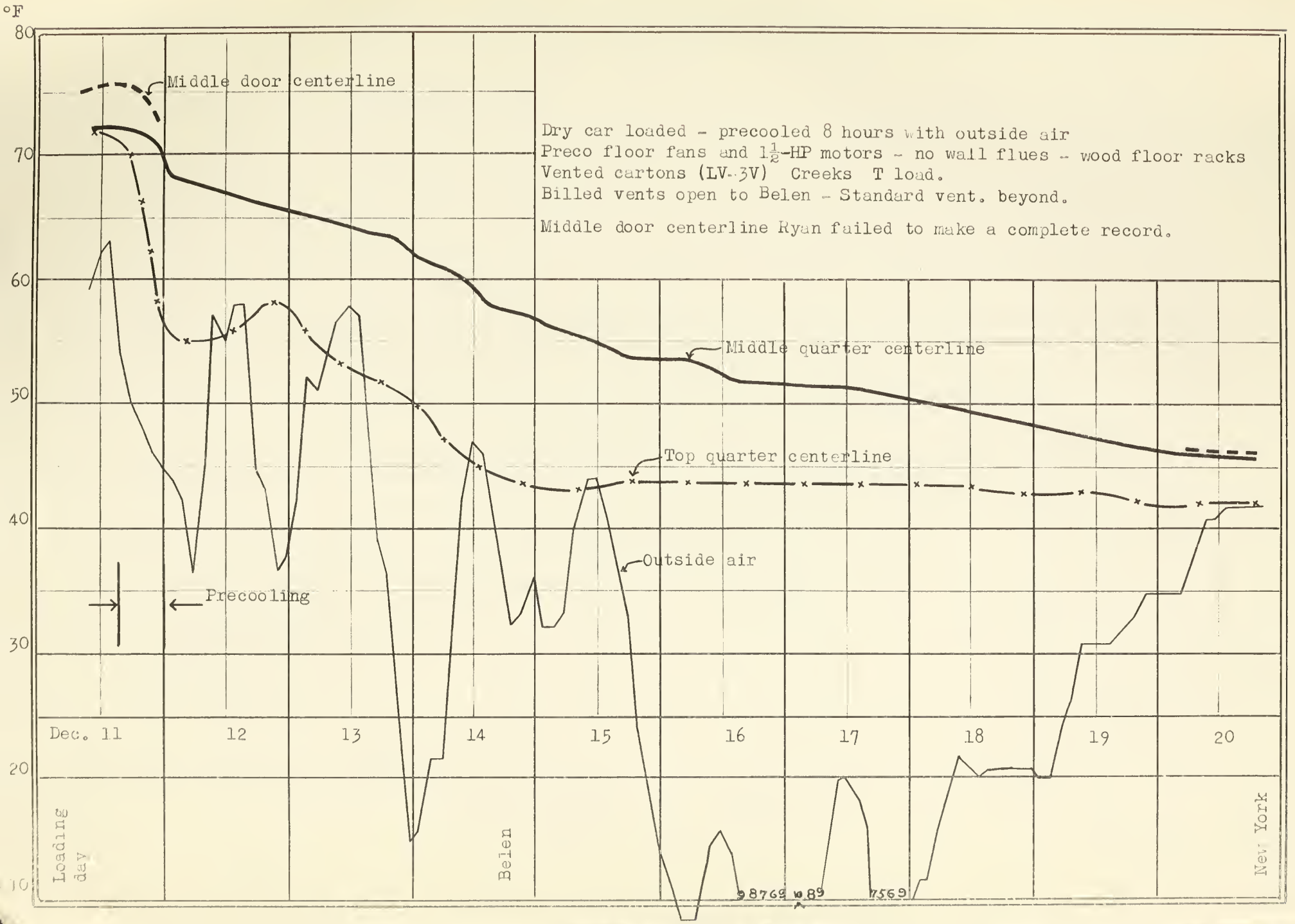


Figure 16 - Test 22 - Navel Oranges
Transit Temperatures by Ryan Thermometers